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Review of Educational Research

VOL. XXV, NO. 5 DECEMBER 1955

GROWTH, DEVELOPMENT, AND LEARNING

AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

A Department of the
NATIONAL EDUCATION ASSOCIATION OF THE UNITED STATES
1201 Sixteenth St., N.W., Washington 6, D. C.

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Active and associate members of the Association pay dues of $8 annually. Of this amount $5 is for subscription to the REVIEW. The REVIEW is published in February, April, June, October, and December. Beginning with the February 1949 issue single copies are priced at $1.50.

Entered as second-class matter April 10, 1931, at the post office at Washington, D. C., under the Act of August 24, 1912.

REVIEW OF EDUCATIONAL RESEARCH

Official Publication of the American Educational Research Association.
Contents are listed in the Education Index.

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Vol. XXV, No. 5 **December 1955**

Growth, Development, and Learning

Reviews the literature in this area for the three-year period since the issuance of Vol. XXII, No. 5, December 1952

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INTRODUCTION

THIS issue of the REVIEW has been organized into six chapters. One chapter on physical growth, covering the age range of human life, reports selections from a voluminous research production in the past three years. The chapter on mental development and mental abilities thru the age span reflects a continuing and sustained research interest in this area. Learning, which presumably is one of the main occupations of school children and, therefore, of prime concern in any review of educational research, is still a nebulous collection of star dust whose formlessness may be due in part to the use of microscopes instead of telescopes. The focus is not yet sufficiently clear to define learning to communicate research freely and with intelligibility to teachers. Emphasis in this issue has been given to personality development and adjustment, the age span being divided among three chapters. Research production continues with infants and preschool children. For the child and the adolescent, research is relatively scanty. Interest in adjustment of the aged has increased and has moved back into adulthood revealing more concern with aging as a process.

In the areas of growth, development, and learning, there is increasing effort to unify theories and to discover higher integrations of research findings.

HAROLD H. ANDERSON, *Chairman*
Committee on Growth, Development, and Learning

CHAPTER I

Physical Growth

KAI JENSEN

PHYSICAL GROWTH is a biological process which involves rates, directions, and patterns of change and development affected by a variety of diverse and complex external and internal factors and causes. It encompasses a diversity of detectable and measurable changes in size, shape, or function occurring in living organisms with the passage of time.

A multiplicity of scientific disciplines study physical growth from a variety of angles at many different levels with increasingly refined and ingenious methods and technics. Genetic origins and backgrounds; reproduction; cell multiplication; protein synthesis; the role of chemical excitors and inhibitors; cell migration; prenatal development; birth phenomena; developmental history of special tissues, organs, and intact organisms; increases in body measurements and changes in shape; comparative growth of groups; interindividual and intra-individual growth; and environmental conditioners and impacts have all proved intriguing and often rewarding fields for study.

Because of the many problems involved, the great variety of disciplines interested, the high stakes, and the many levels and avenues of approach, the literature is vast—far too great to be adequately covered in either the time available or the space at hand. What follows is at best only representative of the work being done in this area.

General Publications and Reviews of the Literature

A recent symposium on the dynamics of growth processes (35) covered such topics as chemical growth in animals, the relation between skeletal "status" based on carpal X rays and bodily maturity, growth curves, and hereditary mechanisms in animal growth. Several general books in the field of human development which contain special sections on physical growth (39, 49, 61, 67, 114, 157, 158, 160, 167, 269, 311, 343) recently were written or revised.

The most recent edition of Holt and McIntosh's *Pediatrics* (150) organized several chapters around body organs and in an appendix included growth tables, norms for body measurements of boys and girls, and nomograms for estimating surface area of infants and children. A recent volume by Dunham (87) dealt entirely with premature infants. Gestation was the subject of a conference (99) held at Princeton, New Jersey, in March 1954. Baker (18), Cruickshank (65), Heck (139), and Jenks (166), published volumes on the exceptional child which include many data on the physical growth of various kinds of atypical children.

Data on the functioning of the endocrine-controlled systems which maintain homeostasis during the course of various diseases will be found in a volume on functional endocrinology from birth thru adolescence (306). This work also contains tables and nomographs for estimating surface area from body weight and height, and other data of value to those interested in growth and development.

The U.S. Department of Health, Education, and Welfare continued to issue bulletins on research in human development currently under way (320, 321, 322, 323). Research listed under the headings, "Pregnancy and the Newborn," "Growth and Development (Physical and Motor Development)," and "Physical Health and Disease," will be of particular value for those interested in physical growth.

Sontag and Garn (289), in a review of growth phenomena restricted to the field of human growth, discussed the various factors which may modify the genetically determined potentiality for normal growth. Among these factors were defective implantation, deficiencies in maternal diet, infections, intoxications, endocrine disturbances, trauma, penetrating radiations, and fetal anoxia.

Soffer and Gabrilove's review (288) of the literature on endocrinology for the year 1954 included 433 references. Two hundred and eighty titles dealing with primary organizer phenomena, gastrular metabolism, protein and amino acids, the serological approach, enzymes and adaptive enzymes, nuclear embryology, experiments with isotopes, affinities and disaggregations, developmental block, and dissection of morphogenesis by metabolic processes were reviewed under the title, "Developmental Physiology," by Needham (236).

Much pertinent material was reviewed in the annual reviews of physiology (127, 128, 129), medicine (68, 69, 70), and biochemistry (206, 207, 208), and the *Year Book of Endocrinology* (117). Harris (136) discussed the need for an interdisciplinary society for research in child development.

Antecedents and Origins of Growth

The biogenetic origin of growth and the complicated environmental circumstances modifying development have challenged and intrigued many observers. Growth may be patterned, ordered, and integrated, or it may be unintegrated, invasive, or destructive. Changes occur with the passage of time, but these time relationships may be altered. Speeding of development may occur to the point where the generation time span is markedly shortened. Slowing may occur to the point where immortality, in a particular tissue at least, is achieved. Reversal occurs where or when rejuvenation is demonstrated.

Just when has the biogenetic die, which determines the future of a given individual, or individuals in the case of monovular origin, been cast? What factors influence this favorably or unfavorably? To what

extent may germ cells be evaluated and selected in advance of conception? How is the progressively changing organization of the fertilized germ cell or reproductive unit controlled? By what biochemical processes are differentiation and orderly growth assured? Spratt (291) reviewed the literature dealing with such fundamental problems as the formation and organization of the ovarian egg; activation of the developmental system; progressive changes in organizations; changes in metabolism during development, regulation, and regeneration; and control of development. Marshall (222) devoted an entire volume to the physiology of reproduction, and Nelson (239) reviewed 223 titles dealing with the subject.

Mammalian Germ Cells (338) dealt with a variety of factors influencing fertilization, embryonic death, ovulation, recovery and transplantation of ova, the preservation of spermatozoa, warmth-induced aspermia, semen quality, factors influencing longevity of sperm in vitro, human spermatozoan production in health and disease, and proteolytic enzymes in human semen.

Moricard (231) reported on fertilization studies of mammalian ova in vivo and in vitro. Chang (54) concluded that the presence of large numbers of spermatozoa in the female tract was not as important as their physiological integrity, which is contrary to common belief. Doyle (83) used the culdoscope to observe and describe ovulation in women and also reported successful conception in 14 out of 17 infertile women, considered to have tubospasm, following denervation of the tubes and uterus.

Asdell (13) studied the effect of several methods of controlling ovulation time upon the fertility of the mammalian egg. Casida's approach (50) to the study of infertility consisted of attempting to induce fertility in animals representing different developmental or functional states, or different genetic or environmental backgrounds, and then analyzing the results in terms of both fertility failure and embryonic death. He tried to separate environmental causes from inherent defects in the gamete.

Terner (309) developed a test for grading semen of good motility of otherwise normal healthy bulls. Factors influencing the longevity of bull sperm cells in vitro were studied by Kok (180). MacLeod (215) reported that he and his co-workers were unable to find any relationship whatsoever between abnormal sperm morphology and fetal abnormalities or failure of conception in humans. Bunge and Sherman (46) reported that it has been shown repeatedly that preserved sperm can fertilize ova in the case of the bull and that recently the same was shown for man.

Krohn and Zuckerman (182) reviewed the detailed observations that have been made on living gametes before, during, and after fertilization by means of phase-contrast microscopy. They also reported that there were differences in the viability of male and female zygotes, and that the differences probably did not remain constant thruout pregnancy. Wolff and others (337) reported the first successful steps in cultivating embryonic tissues in synthetic mediums (total nitrogen).

Fate of Transplants

Autogenous grafts have been made successfully for a long time whereas successful homogenous grafts have proved exceedingly difficult to secure. Some autogenous grafts are impossible to get(for example, corneas), and the real future of grafts lies in the development of technics and procedures which will insure the successful and widespread use of homogenous grafts. Man rarely meets his end as did the one-horse shay, and so the rejuvenation of tissues, and perhaps even of individuals, can never be accomplished by autogenous grafts.

This important problem of preservation and transplantation of normal tissues was the subject of a recently published volume (339). Medawar (225) expressed the conviction that the clinical problem of homografts is definitely soluble. He pointed out that gaps in the immunological defenses of the body that were unthought of even six years ago, have recently been discovered. Deanesly (74) demonstrated that prepuberal male and female gonadal tissue may be frozen and later successfully used as homografts with subsequent production of ova and spermatozoa. Smith and Parkes (286) on the basis of their experimentation in storing and homografting endocrine tissues reported that such tissues seemed potentially immortal under the conditions which they described.

Precocious sexual development as a result of the use of gonadotropic treatment has been reported for many animals. The resultant ova have been successfully fertilized, but such superovulation and superfecundation have led to very small litters or inability to maintain the pregnancy if normal numbers of ova were involved. This raised the question of whether or not such failures were due to any inherent weakness in the ova. Adams (6) answered this question in the negative by successfully recovering and transplanting fertilized ova from immature animals to mature "recipients" and having normal births ensue. By this technic he also made available a new and brilliant method for markedly shortening the generation interval.

Prenatal Development

The functional role of the placenta, problems of sugar transport, and the comparative anatomy and histology of the placental barrier were dealt with in the transactions of the first conference on gestation, held in 1954 (99). In the second edition of Patten's *Human Embryology* (258) even the descriptions of the earliest stages of development were based on human material.

Blood pressure effects under various conditions of stress were recorded, samples of blood taken, and injections made in the same monkey fetus in utero in various stages of pregnancy (272).

Abdominal and vaginal methods of demonstrating the electroencephalogram of the human fetus in utero were developed (30, 37). High voltage slow-wave activity with superimposed small fast waves was found in

fetuses less than three months of age. By use of the electroencephalograph, fetal electrocardiograms were also successfully obtained in 50 cases (29).

A three-channel tocograph, using fluid pressure and a metal bellows, was developed by Embrey (92) for use in the study of prenatal development. Adams (7) used intra-uterine roentgenography as an aid in determining fetal age by checking on the appearance of ossification in the distal epiphysis of the femur which is usually present by the thirty-fourth to thirty-seventh week of pregnancy.

Armitage (12) administered varying dosages of sodium pentobarbital and sodium barbital to rats during pregnancy and then studied the subsequent learning performance of the offspring. The prenatal administration of the barbiturates produced significant impairment of performance in comparison with control groups.

Special Factors Influencing Prenatal Growth and Development

Muller and Rugh stressed the possible damage to posterity that may result from irradiation of the gonads. Rugh (276) urged the use of extreme caution in the use of diagnostic and therapeutic radiation or even of extensive fluoroscopy in the pelvic region on the ground that such X-irradiation-induced changes at the gene or chromosome level are irrevocable, and dosages are cumulative without regard for time. Rugh did not predict that monstrosities would necessarily appear in the first generation, but rather argued that for a dose of 80 roentgens of exposure of gonadal tissue there will probably be a doubling of the normal rate of mutations, a majority of which will be harmful, and that such mutations are hereditary. Muller (234) contended that there is no dose so small as to produce no mutations at all and that even small mutational changes may eventually play a role in the extinction of the line of descent. Patt (257) reviewed 307 articles dealing with radiation effects on mammals.

Greulich, Crismon, and Turner (120), Plummer (265), and Yamazaki, Wright, and Wright (341) studied the effects of the atomic bombing of Hiroshima and Nagasaki on women and children. Greulich and his coworkers used skeletal ages assessed by X-ray photography and matched control groups. They concluded that growth and development were adversely affected by the atomic bombing and that some of the effects were still evident five years later. Plummer reported that 205 pregnant women who were exposed to the irradiation at Hiroshima produced 28 abnormal infants and that the number of malformed offspring increased with closeness to the hypocenter. Yamazaki, Wright, and Wright reported that the mean height and head circumference of children born to mothers with major signs of radiation, such as epilation, oropharyngeal lesions, purpura, or petechiae, were significantly smaller than in those children born to mothers in the control group. Among 30 such mothers there were seven fetal deaths, six neonatal and infant deaths, and four instances of mental retarda-

tion among 16 surviving children. The over-all morbidity and mortality was approximately 60 percent in this group of mothers as compared with 6 percent in a control group.

Kaplan (173) and Rubin (275) reported studies involving third-generation follow-up in women receiving pelvic irradiation. Rubin reported that no acquired lethal effects on the genes were observed in hundreds of babies whose mothers were subjected to X-ray irradiation of the ovaries for menstrual dysfunction and sterility. He also reported no harmful effects in five grandchildren. Kaplan in a similar study irradiated the ovaries of 660 infertile women of whom at least 270 became pregnant and produced 347 children, all of whom were normal. Similar evaluation was made of 14 third-generation offspring in this group.

Collins (62) raised a theoretical issue of general biological significance. She pointed to the fact that during periods of rapid somatic growth there is little development in integrative activity and conversely that integrative growth increases as somatic growth decreases. From these facts she hypothesized a reciprocal relationship between somatic or cellular growth and integrative or functional growth. She further suggested the existence of a closed system of available energies for which the somatic and integrative growth must compete.

Dickerson (77) pointed out that studies of selection and of genetic correlation have both shown that genes influencing rate of growth in body weight had proportionately larger effects on fattening than on skeletal growth and least effect on appendages. Such genes also tended to improve viability, increase efficiency in food utilization, cause earlier sexual maturation, cause larger numbers of ovulations, and cause superior intrauterine nutrition of the young, coupled with slightly inferior lactation.

Congenital Malformations and Experimental Teratology

In the recently published proceedings of the Association for the Aid of Crippled Children (151) the section on congenital malformations considered the background of this subject, the principle underlying experimentally induced anomalies, cortisone induced cleft palate in rats, the effect of amino acid analogues on development of the explanted chick embryo, clinical classifications of malformations during prenatal life, traumatic abortion and prenatal death of the embryo, and statistical approaches to the study of congenital malformations.

Harris and Steinberg (137) reported and classified the abnormalities found during the first six days of life in a sample of 8716 live-born infants. Their classification was according to systems such as gastrointestinal, respiratory, nervous, genito-urinary, skeleto-muscular, blood and cardiovascular, and skin. Stodard (294) studied the relationships between time of insult and the type of malformation. He classified the environmental factors which may produce anomalies as nutritional, chemical, endocrine, radiation, infectious, and mechanical. Marberger and Nelson

(220) used skin biopsies in cases of ovarian agenesis to distinguish chromosomal sex and found the majority of such individuals to be genetic males. Collins (63) reviewed the literature dealing with the incidence of congenital abnormalities following maternal rubella and found that it varied with the stage of pregnancy at which the rubella was contracted. If contracted during the first four months of the pregnancy, the chances of malformations in the offspring were from 70 to 80 percent. After the fourth month, chances of malformation of the fetus were not great.

Several people reported that congenital malformations may occur as a result of defective nutrition during pregnancy. Hogan (149), Nelson, Lyons, and Evans (238), and Workany (340) published comprehensive reviews of the literature on the effects of dietary deficiency in the production of congenital anomalies. Sontag and Garn (289) pointed out that dietary deficiencies experimentally induced during pregnancy have produced a wide range of developmental abnormalities in the offspring of laboratory animals. Giroud (115) reviewed the relationship between avitaminosis and malformation. Cohlan (60) showed that excess vitamin A, as well as a deficiency, may produce congenital malformations. Excess vitamin A fed during the seventh to tenth day of gestation in the rat produced encephaly, eye malformations, cleft palate, shortening of the mandible and maxilla, spina bifida with meningocele, or hydrocephalus in 52 percent of the 148 offspring in the experimental group as contrasted with no congenital anomalies in 1201 control young. He concluded that the developing embryo requires nutrients at critical developmental stages for the orderly progress of normal fetal differentiation and that teratologic effects may be produced by either a deficiency or an excess of specific nutrients at critical developmental stages. Lepkovsky and Borson (194) concluded that in humans nutritional supplements should be provided during the early prenatal period because organogenesis is practically complete 10 weeks after conception.

Hartman (138) reported on experiments furnishing evidence against the notion that all prenatal abnormalities are due to defective maternal environment. His technic consisted in evaluating the growth of companion eggs in the same maternal (uterine) environment. He then attributed embryonic death to inherent lack of growth potential or specific defects in the germ plasm if along with the death the other cell developed into a normal live individual.

Nelson (237) reported that the folic acid antagonist, X-methyl pteroylglutamic acid, when administered to pregnant rats on a folic acid-deficient diet, produced brain injuries including encephaly and many other congenital abnormalities.

Several experimenters (97, 103) administered cortisone to pregnant mice and rabbits. Large doses caused resorption of litters and smaller doses produced a variety of congenital defects with cleft palate the most common visible gross defect. Genetic make-up of the animals influenced the

results markedly as did the gestational stage of the mother. The effect of diverse chemicals on mammalian embryos was studied by Hamburgh (130).

The teratologic effects of ionizing radiation have been verified by several workers. Brent (40) found that irradiating embryos in shielded mothers produced the same types of abnormalities produced by irradiating the mother. He found some abnormalities would occur only if the embryo was irradiated at certain stages of embryogenesis. Most malformations were found to have a wide range of susceptibility, particularly central nervous system malformations.

Hicks (146), Hicks, O'Brien, and Newcomb (147), Russell and Russell (277), and Wilson (335) experimenting with animals found the teratogenic potentiality of ionizing radiation to be high when exposure occurred during the time of major organogenesis. They also found that in some stages of embryonic development a certain amount of damage repair occurred following small total radiation dosages.

Levinson (195) studied the effects of differing amounts of X irradiation at each of five stages of prenatal development upon maze-learning performance in rats. He found such learning decreased with increasing X irradiation and that the learning behavior was most impaired if X irradiation was administered on the thirteenth day of gestation.

Blattner and his co-workers (31) studied developmental defects in the chick embryo following infection with Newcastle disease virus. They concluded that three key factors were involved: the site of the inoculation, the developmental stage of the embryo, and the amount of virus inoculated. Buck (44) reported on the exposure to virus diseases in early pregnancy and the resultant congenital malformations.

Sontag and Garn (289) pointed out that some, if not all, viruses are able to cross the placental barrier with resultant embryological defects if the mother becomes infected during the first trimester, the duration and severity of the infection determining the nature and extent of the ensuing abnormalities. They also pointed out that a great many substances, including sex hormones and antibiotics, may pass the barrier and that the current widespread use of hormones and antibiotics to enhance the chances of a given conception coming to full term may well result in a concomitant increase in the number of defective offspring.

It will be noted that to date, experimental work in this area has produced abnormalities largely, if not entirely, on the debit side. It is certainly conceivable that circumstances exist which would produce deviations from "normal" on the positive side, for surely the present environment is not usually the ultimately optimal.

Vital Statistics

The United Nations published two volumes of accumulated data and interpretations in the field of mortality of young children (318, 319).

These volumes included a mass of information from over 60 countries on all continents on birth rates; still-born; neonatal and infant death rates; and correlations of mortality rates with income, illiteracy, parity, nutritional levels, and other factors. In some countries 20 percent of all live-born children failed to survive the first five years. In 35 countries, where infant mortality rates were comparable, 10 had rates of 100 to 200 per 1000 live births, and in only five countries was the rate less than 50. Strom (295) reported that Sweden leads the world in low infant mortality having a total infant mortality rate of about 20 per 1000.

Bundesen (45) reported the results of a 14-year study based on 10,000 neonatal deaths. He made the interesting point that there was practically no reduction in the mortality of the first day of life over this period of time. Abnormal pulmonary ventilation caused 54.3 percent of the deaths, and birth injuries accounted for 18.2 percent of the total. The correlation with prematurity was found to be high for all causes of death.

Cenci (53) studied infant mortality in the city of Castello for the years 1938 to 1951. He found that infant mortality rose in the war years but has since fallen altho there was no decrease in prematures or infants with congenital or neonatal disorders. Wegman (330) reported on birth rate, death rate, marriage license rate, and infant mortality rate for 1952 and 1953 in the United States.

Douglas (81) published data on trends in the risks of childbearing and in the mortalities of infants during the last 30 years in Scotland. Landucci (186) found that the birth rate in the province of Siena gradually dropped during the years 1946 to 1951 while the mortality among children under one year of age dropped from 68 to 49 per 1000 live births. Deaths in infants under one year of age accounted for 92.8 percent of the deaths of all children under 12 years of age during the year 1951. Both birth and death rates in Italy as a whole were higher than in Siena.

Kendall and Rose (175) suggested an organization and procedure for studying neonatal mortality. Silverman, Fertig, and Kraus (283) proposed a method of computing standardized death rates for premature nurseries, which makes due allowance for distribution differences in the structure of premature nursery populations. Essentially they proposed that the statistical technics of standardization which are used in the study of mortality rates of other population groups be applied to the problem of hospital nursery rates. Age-specific death rates for infants of differing birth weight, gestational age, sex, color, place of birth, and similar data obtained from the pooled experiences of many hospital nurseries were suggested as a basis for a set of standard rates.

Maternal and perinatal mortality in New York City decreased from 1944 to 1951 altho there was no change in the incidence or weight distribution of prematurity (326).

Lewis (196) analyzed data from U. S. Life Tables of the Bureau of the Census on the mortality of white males and females in the different

eras of 1890, 1900, 1910, 1920, 1930, 1940, and 1949. He reported continuous improvement in survival in younger and older age groups with a significant decrease in the older age groups in 1940 and in 1949, except for white males aged 50 to 65 years. White females manifested a significantly higher survival rate at all ages thruout the period from 1890 to 1949, the difference being a major one after the age of 50.

Wegman (331), after studying vital statistics for the United States, concluded that at a given weight Negro babies are more mature than white, children born to parents of lower socioeconomic status more mature than children from higher levels, and plural births more mature than single births. He also concluded that Negro babies of a given weight have a distinctly greater chance of survival than white babies of the same weight and that, as infant mortality rates continue to decline, the relative importance of the newborn period and particularly the problem of prematurity and postmaturity become greater.

Wilson (336) stressed the growing importance of neoplasms as a cause of childhood maturity pointing out that in all age groups from 3 to 10 years, tumors (including leukemia) are one of the first four principal causes of death, tumors of the central nervous system being most common.

Multiple Births

Guttmacher (121) reviewed the literature on the incidence of multiple births in man and some of the multipara with special reference to the variation in the frequency of twin births in various ethnic and social groups. Relative frequency of twin births for 12 countries with available data placed Norway highest with 14.5 per 1000 total births and Japan lowest with 6.5 per 1000 total births.

Nichols (241, 242) combed the literature for accounts of quintuplet and sextuplet births in the United States. He judged most of the reported cases as not well authenticated. Miettinen (229) reported that 633 sets of triplets and 20 sets of quadruplets were born in Finland from 1905 to 1952. Digby (78) described what he believed to be the first case of quintuplet pregnancy in the British Isles.

Lilienfeld and Pasamanick (199) studied the relationship between twin births and race and socioeconomic status. They found an increased frequency of both mono- and dizygotic twin births in the nonwhite population as compared with the white population after making necessary adjustments for economic status, birth order, and maternal age.

McArthur (209) reported a tendency for monovular twinning to increase with maternal age and parity in young mothers in Italy from 1949 to 1950. Maternal age played a larger role than parity. Binovular twinning increased to a maximum at ages 35 to 39 years, the frequency increasing after birth ranks one and two. Binovular twinning was more closely related to modal maternal age than modal birth rank. Karn (174) found that mean birth weight of twins increased with the mother's age up to the fourth birth and that there was an almost linear relationship be-

tween birth weight and gestation time. Low birth weight, first birth, and low age of mother all increased mortality. Friedman (105) pointed out that the possibility of solving the problem of the etiology of Mongolism would be greatly aided by cases of Mongolism in one or both twins provided data were available with respect to their zygosity.

Multiparity

Miller and Oxom both reported studies of mutiparity. Miller (230) studied 563 grand multiparas in New Mexico and found that the incidence of prematurity was 8.8 percent and that it increased with the age of the mother. Oxom (253) found 1056 grand multiparas (seven or more children) in an examination of 63,140 confinements from 1926 to 1952 in Montreal. Eighty percent of the mothers were over 35 years of age and 25 percent over 40. He compared the more common and serious complications in the grand multipara with those in women who had given birth to fewer than eight children.

Prematurity and Postmaturity

Such aspects of prematurity as the general background of the problem, the respiratory exchange, immunology, haemotology, development of enzyme systems, endocrinology, and the prevention of premature births were discussed at a conference attended by 30 scientists from all over the country who met to exchange information, to discuss research methods, and to clarify common objectives in the pursuit of basic knowledge germane to prematurity and related areas (151). Another general and extensive source of information on prematurity is the second edition of Dunham's *Premature Infants* (87).

Clifford (59) summarized present obstetric and pediatric knowledge by which a further reduction in the neonatal mortality rate may be brought about. He agreed with Bloch and his co-workers (32) that the occurrence of premature birth is primarily a public health problem involving the nutritional condition and the socioeconomic status of the mother. Less frequent causative factors were obstetric conditions, ethnic origin, and maternal illness.

Taff and Wilbar (305) reported that the neonatal death rate for immature infants of all races was about 30 times that of mature infants in his Chinese, Japanese, and Filipino populations. Racial immaturity rates ranged from 6 percent for Japanese to 12.1 percent for Filipinos, with a 7.3 percent over-all average.

Verrotti (324) analyzed the causes and frequency of prematurity which occurred during the years 1936 thru 1950 in Siena, Italy. The incidence of prematurity varied from 3.5 percent in the prewar years to 7.3 percent in the early postwar period and then dropped to 5.2 percent in 1950. During the war the rate was 5 percent. There was no increase in death rate during the period studied. Thirty-six percent of the children were born

before the eighth month of pregnancy and 55 percent were born of uniparae.

Houghton and Ross (153), who studied birth weights and prematurity rates in Southern Rhodesia, suggested that the much higher rate which they found among Africans might be due to poor diet and social conditions. Llewellyn-Jones (201) reported that, if the international standard of prematurity were used in the tropics, abnormally favorable mortality rates would ensue and the percentage of premature babies would be abnormally high.

The problem of the long-term prognosis for prematurely born children was studied by Alm (9) and by Douglas and Mogford (82). Alm found the mortality rate considerably higher among prematures especially those who were plural born. After this initial inequality, he found more brain-injury disorders in those surviving three years, altho there was no greater incidence of other disabling diseases. At 20 years the prematures were shorter and weighed less than the controls. In the matter of social adjustment he found no deficiency in the prematures at 20 as compared with normals.

Douglas and Mogford (82) followed a national sample of premature children from birth to four years of age. Thruout this period the children were compared with a closely matched group of controls. There was a tendency for the smallest premature children to be most successful in eliminating their handicaps, and by the age of four years 36 percent of the premature children equaled or surpassed their controls in weight and 44 percent did so in height. Children who by four years of age had eliminated their initial height and weight handicaps were found to have mothers who were as tall and as heavy as the mothers of the controls. Children still lagging behind at the age of four years had mothers who were significantly smaller and lighter than the mothers of the controls. If the children whose mothers were smaller were really just smaller babies, rather than "prematures," this would be further evidence of the inadequacy of the generally used criterion of prematurity which is birth weight of less than 2500 grams.

Longo and Vianello (202) studied 18 reflexes commonly used in clinical tests in 50 immature and premature newborn infants on the first, fifth, fifteenth, thirtieth, forty-fifth, and sixtieth days of life. Reflexes of defense and medullary automatism were found to be more accentuated than in normal infants, but otherwise differences were slight.

Postmaturity, which has an incidence of approximately 5 percent, ranks second only to prematurity as a cause of fetal and neonatal mortality. Like prematurity it is also arbitrarily defined; an infant delivered after a gestational period of 300 days being generally considered postmature. In a sample of 2178 women included in a statistical study (57) where the incidence of neonatal death was approximately 15 percent, prematurity accounted for 36 percent of the perinatal deaths and postmaturity for 30 percent. Postmaturity seems to be a hazard unique to primi-

gravida; in one sample 73 percent of the primigravida whose gestation period lasted at least 300 days did not become pregnant again during the following 10 years (58).

An analysis of 4401 consecutive primigravid labors at term, of which 482 had a prolonged first stage (30 hours plus), showed that stillbirths and neonatal death rates increased with prolongation of labor and that each passing hour beyond 30 increased the number of disasters (251). Higgins (148) recorded a well-authenticated case of pregnancy which lasted for one year and 24 days. It ended in delivery of an anencephalic monster.

Ley (197) discussed criteria of postmaturity in addition to the 300-day gestation requirement. He reported a definite relation between prolonged gestation and dry peeling skin in the newborn, excessively long fingernails, small amounts of subcutaneous fat, and increased length in relation to body weight.

Walker (325) reported that recent physiologic studies showed that the supply of oxygen in a clinically normal pregnancy fell gradually up to the fortieth week and thereafter declined rapidly leaving practically no reserve by the forty-third week. A review of 11,051 deliveries from 1948 to 1952 made it apparent that obstetric death was three times as high at 43 weeks as at 40, and that increased stillbirths accounted for the difference.

In a study (266) of babies weighing over nine pounds who were born during the years from 1949 to 1954, it was found that such large babies were two to three times commoner in white than in Negro patients. Eighty-seven percent of the mothers were multiparas and 20 percent grand multiparas. Nine percent of all mothers delivering infants weighing over 10 pounds were diabetic.

Neonatal and Early Postnatal Development

In a 1953 publication of the Association for the Aid of Crippled Children (151) the sections devoted to birth injury dealt with the clinical impact and pathology of late pregnancy hemorrhage, pathologic changes in the infant in anoxia, placental transfer of oxygen, fetal tolerance of anoxia, and transverse narrowing of the pelvis as a cause of dystocia.

Hewitt and Stewart (145) standardized the first-year weight records of 298 boys and 282 girls in the Oxford Child Health Survey for sex, parity, and parental size. Such standardization reduced the estimated weight differences between infant groups according to maternal efficiency, home amenities, social class, and sickness experience altho bottle-fed infants were still found to outweigh breast-fed infants at the age of one year.

Anderson (10) in another British study found some evidence that birth weight and incidence of prematurity were related to social class. He also found that birth weight increased with parity and age of mother and that subsequent development was affected by birth weight as indicated by height and weight measurements at school entry. This problem was also studied by Herdan (144) who found that birth weight accounted

for not more than 25 percent of the variations in weight found at three years of age. He found that the relationships between birth weight and subsequent weight decreased systematically with the age of the child.

Schlesinger and Allaway (278) studied the combined effect of birth weight and length of gestation on neonatal mortality in a large number of single live births with over 20 weeks of gestation. They found longer gestation increased the chance of survival within each birth weight group of 2500 grams or less and that high birth weight had a similar effect within each gestation group of 36 weeks or less.

Cawley and his co-workers (51) studied the relationship between weight and length at birth and at 3, 6, 9, 12, and 24 months, and the duration of gestation, birth rank, and maternal age in 334 boys and 307 girls. Gestation correlated positively with both weight and length at birth but decreased after birth. Similarly, positive correlations at birth between birth rank and length and weight were found to disappear rapidly after birth. Maternal age had virtually no influence on height and weight at birth, but the correlations became slightly positive at two years. They (52) also reported the relationship between parental stature and birth weight. The influence of prenatal environment on the correlation between birth weight and parental height was studied by McKeown and Record (213). Humphreys (156) analyzed the maternal and fetal weight factors in normal pregnancy in 1000 mothers who delivered 1002 babies.

Mongolism (Congenital Acromicria)

Mongolism is the most common of the congenital growth deficiencies, occurring three to four times in every 1000 births, yet it is poorly understood (28). Ingalls (161) examined 27 references in a critical review of the problem. Lande-Champain (185) studied detailed case histories of 150 Mongoloids and concluded that advanced maternal age did not play a dominating role, "functional" age being more important. Actually she found that Mongoloids who were the first-born children of young mothers outnumbered the "menopausal" babies. Young mothers who had a late menarche or menstrual irregularities before marriage seemed especially to run the risk of Mongolism in a first child. In such instances it was concluded that the Mongoloid did not mark the end but the beginning or regaining of fertility (in some older women). The Mongoloid develops at the border line between sterility and fertility as the result of fertilization of a subnormal ovum. Penrose (262) reviewed 35 references pertaining to the relationship of this growth abnormality to the mother's age.

Oster (250) analyzed the case records of 1000 Mongols traced from 1925 to 1949. Friedman (105) studied Mongolism in 42 twins of unlike sex and 71 twins of like sex. He also reviewed both germ cell theories and environmental theories pertaining to the disease.

Benda and Mann (28) used radioactive iodine in a biochemical and biophysical investigation of Mongolism. They also compared 54 Mongoloids with 54 non-Mongoloid but defective children living in the same

institution, in addition to comparing the Mongoloid group with 1039 normal subjects matched as to age and sex. They found Mongolism was not characterized by unusual serum lipid patterns.

Simon and his associates (284) found no significant differences in the serum protein-bound iodine levels of Mongoloid children as compared with controls of the same age. They did find that mentally retarded children, including Mongols as a group, had significantly higher serum cholesterol levels than did normal children. The level of large molecule lipoproteins of the Sf 12-20 class provided the most marked differences among Mongoloids, normals, and control children. The Mongoloids had the highest level, the cases of undifferentiated mental deficiency an intermediate level, and the normals the lowest level.

Erythroblastosis Fetalis

A major problem in erythroblastosis caused by Rh incompatibility is stillbirth since about 20 percent of the fetuses in these cases die in utero (8). Workers on this problem found that high maternal titer and an unfavorable previous history influenced the outcome adversely and concluded that in these cases the only known method of reducing the frequency of stillbirth late in pregnancy, was delivery before term. Neither cortisone nor other drugs had any value in preventing stillbirths due to Rh incompatibility.

Day and Haines (73) studied the effects upon intelligence quotients of replacement transfusion in recovered cases of erythroblastosis fetalis. A later depression in mean IQ was found even when children with detectable nervous system defect (palsy and the like) were excluded from the population. Depression in IQ was found to be significantly related to the degree of jaundice but not to the degree of anemia. The children who were rated severely ill by both the criteria of severe anemia and severe jaundice averaged 23.1 points less in IQ than did their siblings.

Neonatal Anoxia

Of 85 children who were treated at a children's hospital for asphyxia neonatorium, 18 died during the newborn period. Of the remainder, 19 showed signs of a permanent cerebral injury such as convulsions, mental retardation, and spasticity. A conspicuously bad prognosis was found for children who had convulsions, changed tonus, bulging fontanel, or reduced sucking capacity during the newborn period (141).

Apgar and others (11) recorded objective data relating to neonatal anoxia in an unselected series of 404 infants and then followed their subsequent intellectual development. Using the microgasometric method of Raughton and Scholander to determine oxygen content, and the *Gesell Developmental Schedule* and the *Revised Stanford-Binet Scale*, they found no significant correlation between the levels of blood oxygen content measured in the first three hours after birth and intelligence in early childhood in the 275 cases who returned for psychological tests.

Becker and Donnell (24) asphyxiated guinea pigs in utero after one animal in each litter had been delivered as a control. Some of the asphyxiated animals were released in time for spontaneous recovery while others were asphyxiated to the point where administration of a gas mixture was required for revival. Eight to 10 weeks later all animals were tested in problem and learning situations of two levels of difficulty. Learning and retention performance were inferior for the experimental as compared with the control animals.

Ingalls and his co-workers (163) found that maternal environment and genetic constitution interacted during prenatal development. Using mouse embryos of different strains, they found strain specific differences in susceptibility to hypoxia-induced anomalies of growth.

Leedham (191) reported on glutamic acid in the treatment of mental deficiency. His study is a good presentation of the current status of the problem. Using Form L of the *Stanford-Binet*, *Sequin's Form Board* and *Critchton's Vocabulary Scale* on 12 matched pairs of children aged 4½ to 17½ years, ranging from 2 years 11 months to 7 years 7 months in mental age, he evaluated the effect of 10 grams of glutamic acid given daily for six months to one individual of each pair. The control received a similar quantity of saccharine lactate. No significant difference between the two groups was found. Earlier studies were reviewed and criticized.

Retrolental Fibroplasia (Retinopathy of Prematurity)

Retrolental fibroplasia, which was first described by Terry in 1942, is basically an exuberant retinal vascular overgrowth which is invariably bilateral and results in characteristic retrolental membranes, retinal detachments, and other gross ocular changes leading to impaired vision or total blindness. It is now the commonest late complication of premature birth (143). It ranks first among the causes of blindness in children in the United States and in the case of premature infants is the foremost problem after death itself (189). Ten to 20 percent of babies weighing less than 3½ pounds at birth become blind within the first year after birth as a result of retrolental fibroplasia (89).

Retrolental fibroplasia is a true developmental defect tho extra-uterine in origin. It is more hazardous the greater the degree of immaturity. Sontag and Garn (289) pointed out that the fact that retrolental fibroplasia is brought about by an environmental insult intended to support life (oxygen therapy) should lead to caution and careful evaluation of the use of hormonal therapy, vitamin therapy, antibiotics, and bacteriostatic agents, particularly in connection with the least developed newborn. There is certainly a serious possibility that such agents may artificially induce disturbances of growth in incompletely developed organisms.

Several authors reviewed the literature dealing with retrolental fibroplasia (118, 142, 162, 189, 259, 260). Quite recently a symposium (252) on retrolental fibroplasia was held which dealt with the clinical course

of the disease, the pathology involved, pediatric considerations, the etiology of retrolental fibroplasia, experimental studies in the field, and management of the disease. It was concluded that the incidence of retrolental fibroplasia is positively associated with the use of oxygen, that limiting the amount of oxygen used to that required for clinical emergency in prematures is without effect on the survival rate, and that much of the harmful effect appears to be associated with exposure to oxygen during the first 10 days of life.

Retrolental fibroplasia is most likely to develop in infants beginning life with a birth weight of less than 1500 grams and almost never develops in those with a birth weight exceeding 2000 grams (289). Several workers produced or evaluated evidence pertaining to the rate of oxygen administration in the etiology of retrolental fibroplasia (1, 14, 15, 16, 17, 80, 89, 93, 113, 118, 122, 123, 124, 125, 155, 162, 177, 179, 187, 189, 219, 252, 259, 260, 342).

There seems to be little question but that oxygen plays a major role tho the exact mechanism is not clear. Vascularization of the retina occurs during the fourth to eighth month of fetal life, and it has been suggested that the condition of the capillaries at birth, the rate of growth, and dietary components like electrolytes or tocopheral content may play auxiliary roles (118). Hepner (143) held that any factor which overstimulated vascular growth or which caused intra-ocular bleeding might produce or aggravate the acute vascular lesions of retrolental fibroplasia. Gyllensten and Hellstrom (124) contended that oxygen could not be the only cause of the disease and that it may act by way of an intermediate mechanism which can be provoked by other agents in exceptional cases. Variability in genetic components may also alter susceptibility (163).

Eastman (89) pointed out that the normal fetus in utero exists in an environment in which the oxygen pressure is so low that a healthy adult could survive for only a few moments. He concluded that high and vacillating pressures produced by oxygen therapy might readily have injurious effects in an organism which normally would not encounter such tensions until much further developed. The anoxia which adversely affects immature neural tissue may be produced by inadequate oxygenation of the blood or by exposure to high oxygen concentration followed by rapid withdrawal, an alternation which may result in irreparable damage before physiological acclimatization can take place. Jim and Krause (169) used electroencephalography in the study of retrolental fibroplasia, and Fortier (102) evaluated the therapeutic possibilities of carbon dioxide in the prevention of the disease.

Anthropometric Measurements

General discussions of growth were published by Ojemann (246), Washburn (327), and Weech (329). Concepts of growth and what they mean for the classroom teacher were dealt with by Blommers and others (33),

Jackson and Kelly (164), Olson (247), Olson and Lewellen (248), and Themen (310). Krogman (181) published an article on physical development and growth in relation to student success which may be of especial interest to educators.

Tuddenham and Snyder (314) recently published a study of the physical growth of California boys and girls from birth to 18 years. For use in classroom planning and equipment design, Martin (223), and Martin and Thieme (224) published 45 measurements on 3318 school-age children in Michigan. The 45 tables were arranged by age and school grade. Clements (55) analyzed growth data to determine the age of children when growth in stature closes.

Eppright and Sidwell (94) published means and standard deviations of five body measurements for 1200 Iowa school children aged 6 to 18 years. Meredith and Meredith (228) published data on 16 traits of size and form of presentday white boys and girls attending public elementary schools in West-Central Oregon. Age changes in body form, sex differences in body form, and delineation of the body form of individuals were discussed. Abramson and Ernest (2) found that school boys in Stockholm had increased 15 centimeters in height and about 12 kilograms in weight during the past 70 years altho the increase of height of the adult population was scarcely half as great. A significant correlation between height and social class was reported.

Gesell (114) reported a continuity of functional and physical development during the prenatal and postnatal growth periods up to the tenth year of life. He stressed the evolutionary development of eyes and hand-eye coordinations, basing his conclusions on longitudinal records of premature infants.

Acheson and Hewitt (4) compared the physical development in the English and in the American preschool child using data from the Oxford and the Brush Foundation Surveys. Low (205) published measurements, at various intervals, of 66 boys and 60 girls who were born between 1923 and 1927. The fact that no data were published on the social and economic background of this population throws into relief the difficulty of maintaining constancy of methods in longitudinal studies over considerable periods of time or of providing duplication over an adequate period if advances in technics require it. Acheson and others (5) studied height, weight, and skeletal maturity in the first five years of life.

Hammond (133) measured weight gain during the first year of life of a sample of 451 babies. Weights were measured at four-week intervals, and gain was found to be largely independent of birth weight. Boys gained about one pound more than girls and full-term babies less than prematures. Taller than average babies and those of leptosome type also gained more. Weight gain was independent of social class, was reduced by illness including colds and rashes, and decreased with increasing birth rank. Paiva (254) found that the pattern of growth of breast-fed infants did not differ

significantly from that of bottle-fed infants from birth to six to seven months of age. Meredith (227) reviewed the literature on the comparative size and growth of North American Negro and white infants with respect to eight anthropometric measurements during the first postnatal year.

Staton (292) reviewed 95 publications dealing with the physical growth and health of the adolescent under such headings as growth assessment and anthropometry, morphological and puberal development, nutritional status, physique and motor performance, physique and personality, physiological efficiency, and health. Gallagher and Gallagher (106) published tables relating height and weight values and increments to chronological and skeletal age in adolescents. They also discussed the psychological potentialities of wide divergences in size and growth from the point of view of the adolescent. Johnston (170) and Jones (171) also dealt with physical development during adolescence.

Nicolson and Hanley (243) analyzed data on 180 boys and girls who were measured from the first to the eighteenth year of life. They were concerned with the derivation and interrelationships of indexes which could be used to assess progress along the hypothetical maturational continuum. They used factorial analysis of the intercorrelations among the various measures of maturation in their attack upon the question of generality in adolescent physical growth. They found a high degree of relationship among very different indexes of maturation.

Somatotyping

Sheldon's most recent volume in the "Human Constitution" series (280) is largely a tabular and pictorial presentation of somatotype variations. Part I deals with the nature of somatotypes and general theoretical considerations. Part II contains front, side, and rear photographic views of 1175 men photographed in identical postures, age-height-weight tables, and accompanying text arranged according to the Sheldonian somatotypic scale. This section was based on studies of 46,000 American males between the ages of 18 and 65. Equipment and procedures in somatotyping are also described.

Germain, Browne, and Bellows (112) described several physical profiling systems. Lindegård (200) published a new method of describing individual body build. He used four objectively determined variables, length, sturdiness, muscle, and fat factor, to express both outer body configuration and structure. He used both somatometric and X-ray cephalometric procedures in measuring his factors. This report analyzed 114 references.

Hammond (132) compared physique and development of boys and girls in independent and council schools in England. Weights, heights, and other body measurements for boys and girls from 5 to 18 years of age in independent schools (Group A) were compared with pupils up to 14 or 15 years of age in council schools in the best (Group B) and worst areas (Group C) of several industrial towns. Group A was about two years'

growth ahead of Group C in height and most length measurements. Group A was also about two years ahead in "shape," but for girth measurements the differences were much less. Differences in rate of development rather than specifically social differences were suggested to account for the different mature physiques of the social groups. Hammond (131) in another study used Burt's multiple factor analysis technic to distinguish three body types in a population of 2967 British and American school children between the ages of 5 and 18. Remeasurements after three years indicated constancy of body type to be very high.

A study (95) of the relationship between levels of nutrient intake of Iowa school children and physical and biochemical measurements showed children on diets which conformed fully to the recommended allowances of the National Research Council to be slightly taller, heavier, and larger in leg girth than the children on diets at the other extreme which averaged below the allowances. No significant differences in hemoglobin or serum alkaline phosphatese concentrations were reported. The mean serum concentration of ascorbic acid and carotenoids reflected the intakes of these two substances by the two groups of children. The differences in nutritional status of children noted in this study were small, but the significance of these differences to the long-time health and well-being of children who are on diets which are suboptimal in nutrient content should be assessed thru longitudinal studies.

Bayley (23) studied parent-child similarities in height and weight for children in the Berkeley Growth Study whose records were complete thru 21 years. She concluded that there must be a core of parent-child similarities to account for the increasing similarities which occur up thru the teens even tho such similarities may not have been present during the first year or two of life.

Lorr and Fields (203) published a factorial analysis of the 15 "purest" body types found in a group of 90 psychotic males. They reported the existence of three distinguishable groups of morphological trait patterns that closely resembled the patterns descriptive of Sheldon's components. They also concluded that the 76 somatotypes identified by Sheldon could more simply and economically be defined in terms of measurements on only two type factors. Three new methods for calculating the surface area of the body were described by Schmitz (279).

Trotter and Gleser (313) described a differential procedure for estimation of stature from the long bones of American whites and Negroes. Tanner (308) studied the reliability of anthropometric estimates of somatotype both in the same observer at different times and between different observers. Observers agreed within half a rating on a 7-point scale for 90 percent of the cases; mesomorphy proved the hardest component to rate, and ectomorphy the easiest.

Changes in body build and form with age were pictorially and graphically presented by Boyd (38) both in terms of changes in proportion due to

different rates of growth of the parts of the body and in comparison with the proportion and rates of growth of others.

Dupertius and Michael (88) made a comparative study of the physical growth of 26 ectomorphs and 28 mesomorphs who were somatotyped at the age of 21. The ectomorphs averaged $2\frac{3}{16}$ inches taller and $26\frac{7}{10}$ pounds lighter in weight than the mesomorphs. The mesomorphs outweighed the ectomorphs at each age from 2 to 17 years while the ectomorphs were taller from 4 to 17 years of age. The height of the puberal spurt was reached one year earlier by the mesomorphs while the ectomorphs grew in height over a longer period of time. The mesomorphs grew at a more rapid rate. It was concluded that somatotypes as indicated by measures of height and weight remain fairly constant thruout childhood at least for ectomorphs and mesomorphs.

Parnell (256) reviewed some of the difficulties associated with somatotyping and then described a short physical anthropometric method of estimating Sheldonian somatotype in young men in which the taking of the needed measurements required but five minutes of time. Pugh (267) discussed the charting of growth by means of the Wetzel Grid. Garn (108) studied individual and group deviations from "channel-wise" grid progression in girls and concluded that constancy of channel position was not a usual phenomenon. In his longitudinal series, the proportion still in the "starting" channel was only 50 percent after one year and 19 percent after two years. The short-term series revealed deviations of one or more channels in over 50 percent of the cases in a one-year period and deviations of two or more channels in 9 percent of the cases. In both series, Garn reported a downchannel trend during the earlier years and upchannel trend in later years.

Environment and Physique

Kaplan (172) reviewed 25 articles dealing with the relationship between environment and human physique. She concluded that climate, diet, and altitude all had a significant effect upon the growth patterns of the populations studied. The effect was most marked when one or two vital features of the environment were radically changed.

Newman and Munro (240) measured 15,000 men at the time of their induction into the army and then analyzed the relationship of climate to body size. They concluded that there was a definite association between elements of body size and temperature of habitat. Body size was larger in colder climates, and this relationship was more highly correlated with January than with either annual or July temperatures.

Heights and weights of 392 boys and 409 girls in a South African nursery school measured at quarterly intervals between the ages of $2\frac{3}{4}$ and $6\frac{1}{2}$ years for periods ranging from 1936 to 1951 were found to be definitely related to socioeconomic status (264). At all ages children from the lower income group were significantly shorter and lighter, the differ-

ences being 3 to 5 pounds and 2 to 2½ inches for the boys, and 2 to 4½ pounds and 1¼ to 3½ inches for the girls.

Roberts (274) found a highly significant inverse relationship between body weight in indigenous populations and mean annual temperature, both before and after correction for the influence of group affinity and the influences of stature. Roberts concluded that the relationship between mean weight and environmental temperature made the use of universal "norms" of weight based upon European standards inappropriate in nutrition and growth studies of other populations in other areas of the world.

A close fit between lean body weight and metabolism was found by Behnke (25). When lean body weight was used as a reference, the usual sex differences in basal metabolic rate tended to disappear. Because lean body weight is thought not to change during adult life, Behnke suggested that it could serve as one property of the individual to which many other variables could be related.

Garn, Clark, and Portray (109) studied the relationship between body composition and basal metabolic rate in 49 boys and 49 girls ranging from 6 to 18 years of age. He found that correlations between radiographic measurements of muscle size and basal metabolic rate equaled or exceeded those with measures of height, weight, or surface area. On the basis of his results he suggested the use of tissue measurements in establishing metabolic reference standards.

Wedgwood and his colleagues (328), after pointing out that the commonly used relationship between basal metabolic rate and surface area is not a primary one, analyzed basal metabolic rate and estimates of the fluid compartments of the body in 17 healthy young men. They concluded that basal metabolic rate could be predicted from the volume of body fluid compartments as well as, or better than, from surface area of the body.

Peckos (261) studied 28 endomorphs, 21 mesomorphs, and 37 ectomorphs to determine the relationship between caloric intake and physique in children. She found that the relation of the observed energy intake to body build was opposite to that expected and concluded that weight reductions in an endomorph may require a dangerously low energy intake.

Lasker (190) pointed out the importance of ascertaining the extent to which the diagnostic criteria for each new typology are subject to change under the influence of environmental conditions. He concluded that the description given by Howell's Factor I, is that of the nutritional state and that it accounts for the major fraction of the variance in extreme somatotypes.

Škerlj, Brožek, and Hunt (285) studied subcutaneous fat and age changes in body build and body form in 84 women, 18 to 67 years of age. They concluded that the deposition of inner fat may be an important aspect of the complex phenomenon of aging and that the index of total body fat to subcutaneous fat may measure the aging process. They were unable to determine how much of the increase occurred because of ac-

cumulations of fat in depots and how much was the result of fatty infiltration of organs.

Iliff and Lee (159) found that generally pulse rates, respiratory rates, and body temperatures decreased in children between two months and 18 years of age.

Goldstein (116) reviewed the genetic and environmental evidence bearing on the differences in mortality and health status between whites and nonwhites and found notable progress in the instances of both American whites and nonwhites. He found, among other things, a marked reduction in the rate of mortality among nonwhites in the urban South in recent years.

The relationship between physique and physical performance has been examined by several workers. Bookwalter (36) compared the physical fitness scores of 1977 Indiana elementary-school boys with their physique and developmental level as determined by the Wetzel Grid. Boys of thin or medium physique and those who were very large performed equally well physically. Maximum size and shape did not produce maximum fitness, but a relationship between physique and developmental level did seem to exist. Loveless (204) studied the relationships between scores on the *Navy Standard Physical Fitness Test* and age, height, and weight in 5669 randomly selected cases among enlisted personnel and officers. Height seemed to have less effect than age or weight. Age and test scores were largely unrelated below the age of 30 with a slight relationship above 30 indicated by consistently lower scores. Scores in the more strenuous exercises were adversely affected by weight over 190 pounds.

Pere, Kunnas, and Telkkä (263) studied the correlation between performance and physique in 172 top-ranking track and field athletes. They found that physique had little effect upon performance, high achievement in a given field of athletics being reached by athletes of very different physiques. Throwers were tallest and seemed to benefit from height. Positive correlations were found between relative upper limb length and performance in throwers and in long distance runners and between relative chest circumference and performance in throwers. Negative correlations were found between relative shoulder breadth and performance in throwers and between relative chest circumference and performance in sprinters. Lamp (184) correlated physical size and maturity with volleyball skills of junior high-school students. Tanner (307) examined the effect of weight training on physique. He concluded that the arm muscles in man seem to have a considerably greater growth potential than do the leg muscles. This is an interesting problem, for we have practically no quantitative data on the degree to which human muscles may be increased in size by exercise. We do not know whether the growth of a child's muscles or other tissues or organs is affected temporarily or permanently by muscular exercise. Rarick (270) published a review of the literature dealing with the problem of maturity indicators and the development of strength and skill.

Physical Disability

Barker and her colleagues (21) compared three sources of information as to the frequency of physical disability in children: laymen, teachers, and physicians. Teachers proved to be the best informants, reporting 76.5 percent of the total number of subsequently discovered disabled children. Laymen reported 48.2 percent and physicians 17.7 percent. No survey involving medical examinations was made.

A recent volume (22) on the somatopsychological aspects of the adjustment to physical handicaps and illness contained extensive bibliographies and reviewed a large number of researches in this field. It is a major source book in this area and covers such topics as differences in physical size, strength, and attractiveness; crippling; the tubercular; impaired vision; social psychology of acute illness; and employment of the disabled.

Wenar (333) studied the effects of a motor handicap on the integrative ability by administering Buhler's *World Test* to a group of handicapped and nonhandicapped children. He found a significant decrease in integrative ability in children with a motor handicap and also a tendency for a decrease in integrative ability with increased severity of handicap. No evidence that motor handicap is associated with a particular kind of deviate thinking was found.

Bruckner (41) published a book for parents and others interested in children with a handicap. The author is the mother of a child born a congenital bilateral arm amputee.

Skeletal Maturation

Several writers dealt with the times of appearance of ossification centers. Dedick and Caffey (75) published several charts, based on roentgen findings, which showed the incidence of ossification centers in the skull and chest in 1030 newborn infants. Ellis and Joseph (91) published an account of the time of appearance of the centers of ossification of the tibular epiphyses. Harding (135) used roentgenograms of a group of children taken from birth to 14 years to establish the fact that the appearance and fusion of a second accessory center of ossification of the calcaneus appeared in most instances beginning at one and one-half years before menarche and was fused about one year after menarche.

Noback (244) published a critical summary of the current status of data on the times of appearance of ossification centers and the fusion of bones. He urged that more accurately documented data be made available and that population samples be fully described. He particularly called attention to the fact that times of first observation of a center are usually recorded as times of first appearance whereas the actual first appearance time may have been months before.

Acheson (3) and Harding (134) published methods of assessing skeletal maturity from radiographs. Harding studied approximately 50,000 X-ray

films of 323 children from birth to 14 years of age. She published the percentages of boys and girls having a certain osseous center at various ages and the range of appearance of such centers. On the basis of her experience she also described a simple method of estimating osseous development which is of particular value in longitudinal research. Her subjects tended to maintain fairly constant rates of development over long periods of time.

Mainland (217) and Mainland and Mainland (218) evaluated the skeletal age method of estimating children's development, from the point of view of both systematic error and variable errors. To check on systematic error, expert assessments were compared with each other, and it was concluded that even expert assessment had not reached a desired degree of stability. The variable error in a single observer was studied by means of 1124 readings of 326 films for 233 subjects between the ages of 16 months and 17 years. No significant difference was associated with the Todd or Greulich-Pyle Atlas, the age of the child, sex, differences between skeletal age and chronological age, differences between children, differences between roentgenograms of the same child, or the speed with which the assessment was made.

Greulich (119) reviewed the relationship between skeletal age (based on carpal X rays) and bodily maturity in normal growth, in precocious puberty, and in endocrine dysfunction. He stressed the complications produced by the presence of both early maturing and late maturing strains in the same population. This genetic diversity and nutritional differences tend to make standards which fit a particular group inapplicable to other groups.

Cotellesa and DeToni (64) evaluated the weight, height, and skeletal development records of 500 normal and pathologically abnormal children and adolescents in terms of accepted norms and concluded that skeletal age should afford a useful index of general body maturity.

In Japan, children who were skeletally above average were found to have a greater number of permanent teeth as compared with children who were skeletally below average. At each age level, girls had a greater number of erupted permanent teeth than did the boys (303). Sutow (302) compared the skeletal maturation in 1200 healthy Hiroshima boys and 1150 healthy Hiroshima girls aged 6 to 19 years with the skeletal maturation in American children. He found that the skeletal development of these Hiroshima children, none of whom had been exposed to the atomic bomb, was consistently slower than that of American children of the same chronological ages. In another study in which the skeletal ages of West African Negro boys from 9 to 20 years of age were compared with those of American boys, an average retardation of 16 months was found (332).

Findings of apparent retardation, such as were revealed by these studies, raise the interesting theoretical question as to whether or not we are dealing with a retarded group in the non-American sample or an accelerated American population. Whichever it may be, the further question of the

desirability of such acceleration or retardation, in terms of optimum subsequent development, becomes of vital importance.

Growth of Body Segments and Tissues

A number of workers studied the growth of various body segments and tissues: bones, the head, endocrines, teeth, the eye, the human diencephalon, skin, the blood, subcutaneous fat, and hematopoietic tissues.

Stewart (293) studied the relationship between metamorphosis of the joints of the sternum and age changes in other bones. Moss (232) discussed the differential growth analysis of bone morphology as a useful technic for the study of bone growth. Gardner (107) studied prenatal development and growth of bones in man. Maresh (221) followed the linear growth of the long bones of the extremities from infancy thru adolescence. Park (255) dealt with the effects of health and disease upon bone growth, stressing the need to think of bone in the early period as a very much alive and sensitive tissue. He also pointed out that in times of stress, bone tissue can cease its growth activity and so relieve the general body growth of that added burden.

MacDonald (210) related the head measurements of 1272 infants to estimated periods of gestation and concluded that growth continues in each of the diameters after the thirty-fifth week and that sex does not affect the rate of growth at that stage. In another study (211) he reported that for corresponding lengths of gestation and corresponding birth weights the head of the male fetus is larger and harder. As a sequel to this work, Meredith (226) published a review of more than 50 investigations of the growth in head width during the first 12 years of life in normal North American infants and children. He reported that thruout the period girls have slightly lower means and smaller standard deviations than boys.

Lanman (188) summarized the developmental course, comparative anatomy, and possible physiologic functions of the fetal zone of the adrenal gland. Swingle and Kleinberg (304) reviewed studies of the effects of the growth hormone. Smith (287) studied the action of relaxin on growth of the mammary gland in the rat.

Clements and Zuckerman (56) studied the order of eruption of the permanent teeth in 166 gorillas and 188 chimpanzees and compared the order of eruption with that of 2792 English children. Jeffreys (165) reported on the dental status of children in Delaware. Leicester (192) pointed out that teeth are extremely responsive to systemic and metabolic changes during their early developmental period before eruption and only very slightly responsive to such bodily changes thereafter. He also discussed caries etiology in some detail. Toverud and others (312) published a very extensive review of all phases of dental caries.

McLean (214) and Ridley (273) published material on the growth and development of the lens of the eye. Fletcher (98) studied the pattern of

development of the eye in a series of 320 small, premature infants over the period from April 1950 to January 1953 paying especial attention to the developing fundus oculi. She concluded that there were critical periods of development in the eye when it was particularly prone to retrolental fibroplasia.

Kuhlenbeck (183) published a summary of the development, structure, function, and pathology of the human diencephalon. His monograph presented a detailed anatomical study of the epithalamus, dorsal thalamus, thalamus ventralis, and hypothalamus. This work contained a 421-item bibliography.

Banfield (20) used the electron microscope to study the width and length of collagen fibrils during the development of human skin and in the skin of adult animals. He used human embryos, human fetuses, a three-year-old child, and adults 65, 68, and 85 years of age. Hale (126) published a quantitative and qualitative description of the morphogenesis of volar skin in 122 human fetuses ranging in size from 40-millimeter crown-rump length to 350-millimeter length.

Duggins (86) reported age changes in head hair from birth to maturity using seven boys and nine girls in a longitudinal study. He found that refractive indexes of hair were of some value in indicating the approximate age and the sex of the individuals. Kiil (178), after studying frontal hair direction in American Chinese, Indian, and Negro populations, concluded that frontal hair direction in man may be a result of competition between two growth inducing centers of the skin.

Two books dealing extensively with the distribution of blood groups in man were published recently (233, 268). Mourant's volume (233) included a 97-page bibliography of 1716 items. It was intended to cover practically all existing works on distributions of blood groups. These volumes supplement each other in an excellent fashion.

The relationship between age changes and subcutaneous fat was studied by Eichorn and McKee (90), Reynolds (271), and Škerlj, Brožek, and Hunt (285). Osgood (249) studied the development and growth of the hematopoietic system using a method of analysis which took into consideration the relativity of biologic time.

General or Specific Variables Affecting Growth

DeWijn (76) published a general review of factors governing the development of children. He discussed the relationship of environmental influences, climate, secular changes, socioeconomic status, racial factors, illness, psychic influences, and educational neglect to child growth.

The effect upon growth patterns of chronic nutritive failure was the subject of a series of researches in which indexes, such as height, weight, and skeletal maturation, in children with chronic nutritive failure were compared with those in children without nutritive deficiency. One group of workers (84) found that the degree to which chronic nutritive failure

affected the growth of a child was determined by an interplay of genetic and environmental influences, for, altho striking differences between mean height and weight and speed of growth values were found between the groups with and the groups without nutritive failure, within each age group individual children showed overlapping. It was also found that attainment of maximum physical development depended upon a child's ability to remove any accumulated deficit before the epiphyses and diaphyses of the major long bones fused. In another study (290) it was found that prolonged nutritive failure produced a retarding effect on skeletal development which was largely reversible provided the amount of the nutrient supplement was increased beyond that needed to maintain equality in skeletal maturation between the children in the treated group and the normal controls. Skeletal maturation which was accelerated thru the feeding of essential nutrients did not equally affect all bone centers in the hand and wrist. Consequently it was concluded that all centers of a skeletal area must be evaluated to appraise fully and accurately the growth-promoting effects of nutritional therapy in children with chronic nutritive failure (85). Campbell and McLaughlan (48) published a review of the relationship between vitamin B_{12} and the growth of children.

Crump and Tully (66) administered partial vitamin supplements daily to a group of 50 children who had a clinical diagnosis of malnutrition and anorexia associated with chronic illness. Comparing clinical impressions of improvement with analysis by Wetzel Grid charts, they concluded that the inability of clinical impression to differentiate between actual and apparent growth failure emphasized the need for objective standards in appraising response to nutritional therapy.

In a similar study of growth failure in school children, Wetzel and his colleagues (334) found a significant growth response to nutritional therapy in children previously manifesting retarded growth. Improvement in growth response was not correlated with physical performance as measured by grip, leg, or back strength.

Howe and Schiller (154) graphed data on height and weight for school children in Stuttgart, Germany, from 1915 to 1948 and related these data to changes in diet and environmental factors. The data covered changes in average weight and stature over a long period which included two world wars. Height and weight were diminished during both world wars and increased after each. No data on the adult height of these individuals were given. The effect of climate vectors in growth and development was also studied by Dodson (79).

French and his co-workers (104) studied the effect of dietary fat and carbohydrate on growth and longevity in the rat. The life span of both male and female rats ingesting high fat diets was decreased markedly, tho more so in the case of the males. Their data also indicated that a high fat diet decreased the life span without noticeably altering the cause of death. Increased caloric intake per se was not associated with decrease in life span. Horn (152) found that rats on a protein-free diet were prevented

from reaching sexual maturity. Ershoff (96) reported that proper nutrition is essential for functional integrity of the reproductive system. Bakwin (19) briefly reviewed the psychological aspects of various dietary deficiencies.

In a survey of 285 cases drawn from a total population of 218,693 babies in Birmingham, MacMahon and McKeown (216) found harelip, with or without cleft palate, to be nearly four times as frequent in the offspring of old mothers (38 years of age and older) as in those of young mothers.

Li (198) summarized the chemical and biological properties of the growth and adrenocorticotropic hormones of the anterior pituitary. Soffer and Gabrilove (288) reviewed 433 references on the important role of the endocrines in growth. In another comprehensive review of chemical growth in infancy and childhood, Forbes (101) pointed out the gaps in our presentday knowledge of chemical growth in children. Gaunt (110) recently discussed the endocrine factors which affect growth in a somewhat specific way. He dealt with the pituitary growth hormone, the adrenal cortex, the gonads, and the thyroid. In mammals the major growth stimulant is the pituitary growth hormone. The thyroid hormone is essential for the full action of the growth hormone and also for normal growth and development especially in the young. If it is absent, most food is deposited as fat rather than used for growth processes. The gonads and the adrenal cortex also produce definite but limited stimulants of general body growth.

MacKay (212) reviewed 196 references dealing with the relationships between the endocrine and the nervous systems. Caldwell (47) found that intellectual functioning, speed and flexibility of reactions, and attitudes and interests showed improvement in aged women following sex hormone administration. Thirty women whose mean age was 75 years were divided into two groups for the experiment, the control group receiving a placebo and the other, female sex hormones.

Heller (140) reported that cortisone reduced the resistance of mammals to bacteria, fungi, viruses, and bacterial toxins.

Jervis and his colleagues (168) reported the results of operations for revascularization of the brain in 25 mental defectives aged 3 to 20 years. Postoperative observations were made for two years or more, and no improvement in intelligence quotients, electroencephalographic findings, or clinical symptomatology was found. They also reviewed the data obtained by other investigators in a total of 331 cases and discussed theoretical aspects of the problem.

Tyler and Armstrong (315) reviewed the evidence dealing with the metabolic aspects of some neurological and muscular disorders. They concluded that many studies of metabolic changes in schizophrenia suggest that a metabolic derangement underlies the disease process. They also pointed out that there is good evidence that patients with several types of endocrine abnormalities manifest an unusually high incidence of psychoses altho the position that all psychotic patients show an abnormality of endocrine function is much less well established.

Methodology and Technics

Asdell (13) reported that several methods for controlling ovulation time in mammals were available. These procedures, combined with technics for preserving tissues indefinitely and transplantation developments, should open up a whole new era in the study of growth. Indeed, in his foreword to a recent volume entitled *Mammalian Germ Cells* Folley (100) stated that the technical advances foreshadowed by the researches reported in this volume might well be fraught with as much significance for man, and danger of misapplication, as the discoveries on how to release the energy of the atomic nucleus.

The advantages of the longitudinal method of studying growth, and the problems associated with the approach, are well known. Bell (26, 27), in partial solution of some of these difficulties, suggested a method of combining the cross-sectional and longitudinal technics in such a manner that long-range developmental changes may be estimated in a relatively short period of time. He suggested that groups be selected so that final measurements on a younger group could be made at the same age as the initial measurements of the next-older group. By this procedure, for example, a longitudinal study which normally would take eight years might be accomplished over a two-year period if four slightly overlapping age groups were used. Both absolute measurements and directions of development could be ascertained and used to help answer the question of whether or not age changes only were involved. He pointed out that such a short-cut method would be particularly helpful in studying transient populations or relatively uncooperative groups and wherever extensive study leads to undesirable contamination of the population universe. It could also be used to point up special problems and to obtain initial results to further experimental design in longitudinal studies.

Suarez (296, 297), Suarez and Peva (298, 299, 300), and Suarez and Tirjeira (301) critically evaluated methods used to show growth and development beginning with Quetelet in 1871 and including the grids of DeToni, Gobesi and Tatafiori, and Wetzel. The authors also presented a new method of graphic representation of growth which permitted the visualization of developmental age, velocity, and direction of growth. LeLong and his colleagues (193) also published a new method of graphically recording growth which made it possible to compare the child with himself at successive ages and to attack some of the unsolved problems of auxology.

Bryan and Greenberg (43) investigated methods suitable for cross-sectional determination of immaturity points and sexual maturation. They compared three methods: logits, probits, and Karber's method, and critically evaluated each. In a later paper Bryan (42) published methods for analyzing and interpreting physical measurements of groups of children.

Tyler (316) critically evaluated various concepts of organismic growth with regard to their statistical bases, their psychological meaning, the validity of interpretation of basic data, and their important educational

implications. He stressed the need for further empirical studies in this area. In another publication, Tyler (317) suggested the use of *P*-Technic in the study of the interrelatedness of rates of growth of children. Organismic concepts, such as "unity of growth" and "interrelatedness of the growth process," have been given great educational and psychological significance, yet, referring, as they do, to intra-individual growth, they cannot be verified by data about interindividual growth.

Nicolson and Hanley (243) published a factorial analysis of the intercorrelations among a group of indexes of physiological maturity obtained in an urban sample of 180 boys and girls who were measured annually from their first to eighth years and thereafter semiannually until they were 18 years of age. In this study of the generality of growth a high degree of relationship among very different indexes of maturation was found.

Kerlinger (176) recommended the use of analysis of variance with child development data, particularly those data covering ages from 6 to 10 years. He reported that analysis of variance could be used to determine the significance of the difference between growth ages and between organismic ages, and within certain limitations, could give the degree of homogeneity and heterogeneity.

Electroencephalography was used to study the developing brain of the intact prenatal human fetus (30, 37), the developing heart in the intact prenatal human fetus (29, 72), the normal aged adult (245, 281), brain phenomena in senile psychoses (235), and in retrolental fibroplasia (169). Blum (34) checked on the reliability of electroencephalographic judgments by having 10 sets of electroencephalographic records evaluated by five experienced neurologists. He found the reliability to be low and emphasized the need for further research in this area.

Geoghegan (111) devised a system by which a wide range of body measurements, surface area, and total and partial body volumes could be obtained from photographs of subjects in certain postures. The body specific gravity value could also be calculated if body weight were known.

In a paper which was concerned with regularities in growth curves including rhythms and allometry, Sholl (282) made the point that accurate knowledge of growth of individuals or the growth process itself cannot be accomplished by deriving a kind of average curve from measurements of different individuals at different ages. No amount of mathematical theory or statistical practice can ever supplant the endless experimentation which lies at the base of progress in biological science. Peculiarities of growth data may be due to a peculiarity of the individual, a characteristic of growth of human beings, or an error of observation.

In an important methodological note, Davies (71) pointed out that mortality statistics based on either cross-sectional or longitudinal data are limited in answering the question as to how fast man is aging at different periods of his life. Indeed, he concluded that the average rate of inherent aging will probably never be known because ideal environmental conditions

which would be optimal for all, and hence not shorten life, do not exist now, nor are they likely to appear in the forseeable future. This is just another way of saying research must be continuous, that we shall not run out of problems, and that progress consists of a series of approximations or approaches to an ever receding and more enticing goal.

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CHAPTER II

Mental Development in Infancy and Childhood and Mental Abilities in Adult Life

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EARLIER reviews of mental development in this journal (39, 56, 121) focused primarily on the period of childhood and adolescence. Longitudinal studies are now beginning to yield information on age changes later in the life span of individuals first tested in childhood or adolescence. Therefore it seems appropriate to consider both types of studies in this review. Research workers continue to show an active interest in the consistency of test performance at different ages and in factors related to change in test performance. The effect of environmental variables on mental development constituted the subjectmatter of a review by Jones (65), in which over 300 of the major studies in the area were considered. Other topics which received attention recently include the role of emotional and motivational factors and the problem of the extent to which IQ changes represent true changes in relative standing or are attributable instead to test construction, test standardization, or other psychometric factors.

Group as well as individual differences were examined in numerous studies. Especially prominent are the analyses of test performance of institutional and defective children and studies of various socioeconomic and ethnic groups. Darcy (30) published a review dealing with research on bilingual subjects. Many investigations were made of the differential responses of groups with different physical and mental disorders. Milner (83) reviewed the literature bearing on the intellectual changes resulting from temporal-lobe damage. Altho no striking gains have been made in the methodology of research on mental development, existing methods and theory continue to provide scope for vigorous research activity.

Research on mental development of the infant still tends to be directed at determining the predictive value of tests given in infancy. Macfarlane (76), summarizing one of the longitudinal studies at the University of California, drew implications as to the use of infant tests in adoption. Prospective parents whose expectations would be met only by a child of superior ability would do well to delay adoption until a child has reached an age, beyond infancy, when prediction from tests can offer somewhat greater promise of accuracy.

Griffiths (49) developed a new test for the first two years, standardized on a sample designed to be representative of the London population.

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A correlation of .87 was reported for a group of 60 infants retested after an average interval of 30 weeks. Further work with this test will be needed to determine if this exceptionally high relationship is in part a function of the heterogeneity of the intervals between the retests. A special advantage of the Griffiths test is a correction which has been built in to give an essentially constant standard deviation at the different ages. With moderately promising results, Catalano and McCarthy (22) explored the feasibility of using certain measures of infant speech to predict later intellectual status with 23 institutionalized children of borderline ability. Evidence is lacking as to whether their procedure would be similarly successful within a normal range of cases.

As noted in the 1952 review by Eichorn and Jones (39), an alternative suggestion for improving the predictive value of infant tests is that only those testings should be used in which the examiner judges that the infant is achieving optimally. Gallagher (43) found a significant increase in a later score among children whose initial performance was judged to be suboptimal. The validity of test results obviously depends upon effective cooperation from the subject, and this degree of cooperation may be an especially important factor in tests obtained at early ages.

Abilities at Different Developmental Levels

Interest in determining those clusters of abilities which tend to vary together has remained high, as is shown in the continued reporting of factor analytic studies of intelligence test performance. Of special interest is Hofstaetter's test (57) of Bayley's hypothesis that mental tests measure different abilities at different ages. Using the intercorrelations between tests administered to the same group of subjects in the Berkeley Growth Study at a large number of ages during their first 18 years, Hofstaetter obtained three relatively independent clusters of abilities: Factor I, "Sensori-motor Alertness," most prominent in the first year; Factor II, "Persistence," most evident in the second and third years; and Factor III, a broad factor which accounts for most of the variance from four or five years of age to 18 years. Results of an unpublished analysis of these subjects' performance in terms of yearly gains generally support Hofstaetter's conclusions. However, both of these studies leave unanswered the question as to whether the obtained organization of abilities is chiefly a reflection of the organization of the tests, the inherent functioning of the organisms, or of correlated environmental demands, pressures, and expectations. Regardless of how these questions are eventually answered, the practical implications of Hofstaetter's research are in agreement with earlier conclusions drawn from longitudinal studies; namely, that tests currently in use have little predictive value when administered much before the age of four years. Hastings (54), however, showed that by item analysis it is possible to derive for the early years more predictive

scales of adult status. The data used were from the Guidance Study and the Berkeley Growth Study samples at the University of California.

Somewhat different clusters of abilities continue to be reported from factor analyses, depending on the methods used and the abilities sampled (29, 36). Generally the number of factors reported tends to be somewhat larger in late childhood, adolescence, and adulthood than in the earlier years. Burt (17) emphasized this point and related it to biological and neurological findings, maintaining that with age the functions become more differentiated. In his factor analysis of *Wechsler-Bellevue Intelligence Scale* performance of 90 subjects between the ages of 60 and 74, Birren (13) assumed this differentiation and concluded that, because too few independent functions are measured by the *W-B*, the scale is of limited value in describing age changes in different abilities.

Adult Mental Abilities

Studies of the consistency of intelligence test performance over a period of years usually have been limited to children and adolescents; however, we are now beginning to secure results from several longitudinal studies extending into the adult ages. One of these is the Stanford Study of the Gifted. Bayley and Oden (9) reported a correlation of .88 between two forms of a concept mastery test administered at 12-year intervals to 422 men and 346 women of the Stanford Study. Some of the spouses, a more heterogeneous group in terms of ability, were also tested on the two occasions; the correlation was .92 both for the 144 husbands and for the 191 wives. In contrast to the decline in performance with age usually found for more representative samples of the population, these investigators reported an increase of approximately one-half a standard deviation during the adult age spans of this study.

In a follow-up of 83 cases originally members of the Adolescent Growth Study at the University of California, Jones (64) compared performance on the *Terman Group Test of Mental Ability* given in Grade XI and again at approximately age 33. Retest correlations of .84 for the men and .90 for the women were reported. Nearly all cases showed a gain in mental age, the average gain amounting to seven-tenths of a standard deviation of the eleventh-grade distribution. The larger part of this, however, can be attributed to general mental growth in the years immediately following the eleventh-grade testing and to growth in abilities based on vocabulary.

Owens (87) reported a gain, between the ages of 19 and 50, of one-half a standard deviation on the *Army Group Examination Alpha* for a group of 127 college graduates tested originally as freshmen. Here, also, it seems probable that a large part of the gain was concentrated in the years following the initial test. Owens and Thompson (88) conducted a more recent investigation to determine whether gains on the various subtests are related to the degree of parent-child resemblance. In this study they correlated, subtest by subtest, scores on the *Army Alpha* made

by 102 college students with scores made by their parents 25 to 30 years earlier. Over the 30-year period, the parents gained less on subtests in which their scores showed the greatest resemblance to their children's scores. A possible interpretation is that these functions are to a greater extent genetically determined. Functions of a more informational character or dependent on vocabulary may show continued adult gains and less predictable parent-child resemblances.

The question has often been raised as to the extent to which age changes in intelligence test scores are determined by loss of speed in test performance rather than by loss of mental "power." Several recent studies bearing on this problem were reviewed by Jones and Kaplan (66). Jones (63), in a reanalysis of earlier data published by Jones and Conrad, examined the influence of speed factors in a test of analogical thinking which had been shown to yield an early and marked decline with age. A control of the speed factor by scoring correct answers as a percentage of those attempted failed to reduce the age decline. In comparing different tests, Jones noted that the age change tends to be greater in those tests which more directly show, not the effects of earlier learning, but the functioning of current abilities.

In a restandardization of his intelligence scale for adults, Wechsler (116) administered the tests to random samples of the older population of Kansas City, aged 60 and over. When test results under fixed time limits were compared with results under unlimited time, it was found that older subjects are negligibly, if at all, penalized by the speed factor. They are, to be sure, penalized by their own decreasing ability, but this is manifest in a similar way with and without time limits. Similarly, Schaie, Rosenthal, and Perlman (101), using both timed and untimed tests of primary mental abilities with 61 subjects aged 53 to 78, found differential decline whether or not the tests were timed.

Thurstone (111) made an important contribution to the literature on differential mental growth thru the comparison of Gompertz curves and the various ages of adult asymptotes for seven primary abilities. Earliest maturing is shown by the perceptual speed factor, which reaches 80 percent of the adult level at the age of 12. The space and reasoning factors attain the same relative efficiency at age 14, and the number and memory factors at about age 16. Verbal comprehension and word fluency mature relatively late, and this is in accord with studies of adults which show continued gains in vocabulary tests at ages during which other functions are declining.

Laboratory studies, also, yielded significant evidence on the problem of mental changes in adult life. Singleton (105), in analyzing age changes in motor skills, found that for marked changes deterioration is related less to peripheral than to central factors. In other words, the change appears to be less a matter of loss in motility than in operations involved in programing a skilled act or in other aspects of mental control.

Age changes in perceptual abilities may play an important role in the deterioration of complex mental functions in old age. Birren (12) summarized a number of studies bearing on this problem. The age changes

may rest to some extent upon mere loss of speed, resulting in a handicap in integrating data because the perceptions lag behind changing situations or because essential elements in a problem are lost before other relevant factors can be brought into relation to them.

Kay (70) conducted a series of learning experiments of varying difficulty. Diminishing efficiency with age was shown in each experiment and was more marked as the tasks became more complex. He considered that this was related to a loss of flexibility in adapting to new conditions and new data.

One of the most extensive recent studies (89) is a survey of over 4000 French railway operatives, aged 20 to 55, and apprentices in training schools, aged 12½ to 15½. Tests of memory, attention, comprehension, reasoning, and psychomotor function showed a decline in performance beyond age 25 or 30. The onset of a marked decline was later in psychomotor than in other tests. The greater decline in more difficult or more complex functions, as well as the smaller age differences at the higher ability levels, supports evidence reported by other investigators.

Age changes which are manifest in mental tests and in perceptual and motor functions have their parallel in records of creative activity and personal achievement. Here, however, the peak of performance is considerably later than in standard tests since creative production usually requires long-term effort as well as the development of opportunities and facilities. The most extensive series of investigations in this field, by Lehman (73), indicates that in most intellectual occupations the highest *quality* of work is usually accomplished before the age of 40. Dennis and Girden (33) applied a quantitative measure, rate of publication, to psychologists in various age groups. The highest rate was found in the 40's, with a decline of about 50 percent in the age group 60 to 69.

Constancy of the IQ

Factors which may result in variation in mental test scores have received special attention in recent research. These include differences in methods of appraisal of intelligence, statistical features of the tests, contributions of the examiner to score variation, and practice and coaching effects.

Psychometric Considerations

The validity of estimates of intelligence from interviews has usually been looked upon as open to doubt. Recently, however, Wilson (117) showed that such estimates can have a fair degree of validity. He reported a correlation of .74 between test scores predicted from a structured interview and scores on group tests for 160 adult subjects. The interview covered in detail the subject's personal history, including occupation, education, family, and the like. Altho this study indicates that test scores can be predicted with considerable accuracy by one who has had extensive ex-

perience, the study does not show how much experience is needed to achieve this level of accuracy nor what proportion of examiners can hope to achieve this level. Alexander's study (1) of teachers' ability to judge intelligence and achievement indicates that the typical teacher is less successful in judgment. Alexander had five teachers in Grades V thru VIII pick out the five most intelligent and the five least intelligent students in their classes. They were correct less than 60 percent of the time, using scores on the *California Test of Mental Maturity* as the criterion, and were correct only about one-fourth of the time in picking out the high and low achievers on the *Stanford Achievement Test.*

Even if objective tests of intelligence were accepted as the only valid way of estimating intelligence, change in score is likely to be considerable from one test to another as different tests are used. This effect, predictable in part from the correlations between the tests, was emphasized by Dreger (35). Triggs and Cartee (112) reported a 15-point difference in mean score for 46 five-year-olds tested with both Form M of the *Revised Stanford-Binet Scale* and the *Wechsler Intelligence Scale for Children,* with *Stanford-Binet* scores not only higher but less variable. The tendency for children to score higher on the *Stanford-Binet* was also observed in Cohen and Collier's study (26) of children six to eight years old. Differences among mental tests in average scores and standard deviations may spuriously increase the apparent inconstancy of the IQ when the same subjects receive different tests (11, 31, 71, 108, 110). Taking cognizance of this factor, Heil and Horn (55) prepared a table for equating scores on several groups tests. Such studies as those noted above indicate that a similar step needs to be taken with the major individual tests of intelligence, utilizing a representative sample of subjects at each age.

As early as 1942, McNemar presented corrections for change in variability with age for the *Stanford-Binet.* Altho this procedure was recently challenged by Elwood (40), McNemar's reply (79) appears adequate. The desirability of correcting *Stanford-Binet* scores for age changes in variability was independently confirmed on longitudinal data by Pinneau (90). The findings of this study indicate that such corrections result in greater stability of scores after the age of eight and suggest that the reported greater instability of scores for the more intelligent may in part be artifactual. A different method of correction for dull children with IQ's above 40 was recommended by Roberts and Mellone (94) and independently confirmed by Scarr (100).

Contribution of the Examiner

Attention has recently been directed to the effect of the examiner's personality, sex, and personal appearance on test performance. Holtzman (58) investigated this, employing the drawing of a person, which is used both as an intelligence test and as a projective technic. From an analysis of data collected on 40 male and 40 female college students he concluded that no variations in the drawings were due to these traits of the examiner.

Sacks (97) conducted a study directed toward determining whether the child's acquaintance with the examiner is an important variable. She found that three-year-old children did significantly better on a second testing if they had become well acquainted with the examiner. Altho the gain was greatest for those with whom she had a good relationship, it was evident even for those with whom the relationship was poor. The study suggests not only that familiarity with the tester makes a difference, but also that the nature of the social relationship between examiner and testee is important. This study needs to be repeated in other age groups to determine whether the examiner-testee relationship is as important at other ages. If not, such findings might be interpreted in terms of overcoming negativism.

Practice and Coaching Effects

In England it has become established practice to determine at about the age of 11 whether or not pupils will be admitted to the college preparatory curriculum. Performance on intelligence tests provides a basis for the decision, and, as a result, coaching and unofficial practice have become quite widespread. Several extensive studies of the effects of practice and coaching were reported in a 1953-54 symposium. James (61) and Yates (122) reported gains of 4 to 6 points in coached groups and gains of essentially the same magnitude for practiced groups. Dempster (32) and Wiseman (119) reported gains as high as 9 to 11 points with sufficiently extensive coaching. Wiseman found that practice gains were related to initial ability; comparing groups averaging 80, 100, and 120 in IQ, he reported average gains of 4, 11, and 18 points, respectively. Further investigations are needed to confirm this finding since the positive relationship did not hold in the coached group. In summarizing the various studies presented in the symposium, Vernon (115) noted that altho general effects of practice and coaching are limited, the allocation of children at the border line is affected and that both students and the test items vary in their susceptibility to coaching and practice. Results of these studies appear to be in essential agreement with earlier investigations made in this country.

Intelligence and Achievement

From the earliest days of mental testing, a major function of intelligence tests has been the prediction of academic achievement. In a recent study Frederiksen and Schrader (42) compared *American Council on Education Psychological Examination* scores with high-school standing for 2030 freshmen in 12 colleges. The correlations found were of the order of .50, which is in substantial agreement with earlier studies. With a weighted composite of *ACE* variables, a median multiple correlation of .68 was obtained for nonveterans and of .60 for veterans. Even the highest of these relationships leaves more than half of the variance unexplained. A study by Carter (21) indicated the degree to which grades are independent of

achievement measured by tests. For a group of students in beginning algebra, teachers' marks correlated only .52 with proficiency as measured by achievement tests. Taking cognizance of the variance in grades unexplained by intellectual variables, Gough (45) derived a true-false "personality" scale to predict academic achievement. In the cross-validation study on 234 high-school seniors, scores on the scale correlated .44 with grade average and .26 with IQ. The IQ's correlated .47 with grade average. IQ and score on the personality scale gave a multiple correlation of .62 with grade average.

Coleman and Cureton (28) recently raised again the question of whether it is desirable to use both group intelligence and achievement tests when they are so highly related. In their study they found a 95-percent overlap between the *Otis Quick-Scoring Mental Ability Test* and three subtests of the *Stanford Achievement Test.* They suggested that achievement tests may permit a better inference about differences in native capacity than do group intelligence tests.

The relation between intelligence and achievement among the mentally deficient was studied by Bensberg (10) who used the *Stanford-Binet* and the *American School Achievement Test* with a sample of 274 male and 230 female mental defectives. In general, achievement was not significantly below mental age. Females matched with males for CA and MA were found to achieve significantly higher on both reading and arithmetic. The differences between brain-injured defectives and familial defectives were not significant, nor were the differences between those who had attended public school prior to commitment and those who had attended the institution school for five years or longer.

The relation between mental test scores and the ability to learn as measured by performance on simple learning tests was investigated for eleventh-grade pupils by Green (47). The correlations between *Otis Gamma* scores and five simple learning tests ranged from —.14 to +.33. A comparable range was obtained between the learning test and school marks, —.02 to +.30. IQ correlated .54 with school marks. A more "global" approach to this problem was used by Smith (107). In a program of educational enrichment he found that bright students learned more than dull ones from motion pictures and that change in relative standing in the class in terms of achievement was little affected by the introduction of movies.

The relation of intelligence and reading ability to literary appreciation was investigated by Burton (18). Among 190 twelfth-grade pupils literary appreciation as measured by three tests was more highly related to verbal intelligence ($r = .44$ to $.64$) than to reading ability ($r = .27$ to $.47$). Schmidt and Rothney (102) studied the relationship between primary mental abilities and occupational choice among tenth-grade students. In this group occupational choice was found to be fairly stable, 83 percent choosing in an interview the same occupation that they had chosen on

at least one of two other occasions. On the average, subjects choosing a given occupation made higher scores on the subtests described as necessary for the occupation.

Sex Differences in Intelligence

In major individual tests of intelligence, such as the *Stanford-Binet*, sex differences on the individual items were recognized in the standardization of the test. "Sex weighting" was avoided by counterbalancing the sex differential on one side by the inclusion of items with an opposite bias. Altho such corrections are sufficiently effective for the middle range of abilities, they do not necessarily correct for sex differences found in groups extreme in ability. In an investigation with a group test, Clark (24) compared a sample of 136 male freshmen with 136 nursing school candidates, each group averaging around 117 IQ on the long form of the *California Test of Mental Maturity*. The memory factor favored the women and the verbal concept factor the men. The men were more variable both in the language and in the nonlanguage areas and on three of the five factors; however, Clark concluded that sex differences are not so great as to require separate sex norms. In investigating sex differences at high levels of ability, Norman (86) used the *Wechsler-Bellevue* on a sample of young adults all of whom had IQ's of 120 or better. The only subtests on which the groups differed significantly were arithmetic, which favored the men, and digit symbol substitution, which favored the women; thus, the sex differences tended to cancel out in the full-scale IQ scores. He also determined *Wechsler's* deterioration quotients for the groups and found significant irregularities in the profiles of the weighted subtest scores, apparently a function of sex and IQ level. These irregularities so affected the deterioration quotients of these apparently normal subjects that the validity of the ratio for high-ability groups appears questionable.

Intelligence and Socioeconomic Status

Research interest in the relationship between mental test performance and cultural variables, reflected in the large amount of space required to cover this topic in a previous review (39), continues unabated in current research reports.

Haggard (51) reported an experimental study of ways of reducing the differences in test performance between social status groups. The subjects in the study, 671 11-year-old children of whom half were from high status groups and half from low status groups, were assigned to 28 subgroups on the basis of status characteristics, age, grade, and *Kuhlmann-Anderson* IQ. Eighteen of the 26 groups who took the initial test received practice periods of 50 minutes per day for three consecutive days. Half of these received special motivation during the practice periods and half did not.

These groupings were subdivided into those who did and those who did not receive special motivation during retests. A further subdivision was in terms of those receiving the standard retest and those receiving a form of the test, supposedly revised so as to reduce cultural bias. Haggard found that the performance of the high and the low status groups was differentially affected by practice, by incentives, by the form of the test, and by whether or not the test was presented orally. While certain of the experimental procedures reduced the social-status differential, none of the effects was sufficiently strong to eliminate it or to reverse the relationship usually found. The interpretation of the results was generally in line with conclusions reached by other members of the Chicago group; namely, that the differences between status groups on mental tests are to be explained in terms of cultural influences rather than in terms of "true" differences in ability. More specifically, Eells (38) suggested that the differences may depend on different opportunities for familiarity with test processes and content; however, Tyler (113), in a reanalysis of Eells's data, showed that, when plotted against status, the regression lines for verbal and nonverbal measures of intelligence become very similar if the scores are first transformed into standard scores. He held that positive knowledge of the basis of status differences can be provided only by experimental evidence.

Britton (15) investigated the relationship between social class as measured by *Warner's Index of Status Characteristics* and intelligence as measured by several group tests. For 102 boys and 130 girls the correlations ranged between .42 and .53 for all tests except *Goodenough Draw-a-Man*, for which the correlation was .11. Except on the latter test, the mean IQ's were above 100 for the higher status subjects and below 100 for the lower status subjects. The *Goodenough* IQ's for both high and low status groups averaged in the 80's. Britton maintained in conclusion that the task is to develop intelligence tests independent of status; however, Budd (16) challenged this point of view on the basis that it would reduce the practical predictive value of mental tests.

Anderson, Brown, and Bowman (7) sought to determine the relationship between intelligence and occupational mobility in a study of the American ideology of "room at the top." They took into consideration three components in occupational mobility: inappropriate occupational location of father, in relation to intelligence; regression of intelligence of sons; and shifts in occupational structure from one generation to the next. They concluded that to advance studies in this area a more adequate measurement of the correlation between intelligence and occupational mobility is needed.

Differences among Ethnic Groups

The use of tests on groups other than on those for which the tests were standardized is a problem of major importance in ethnic group com-

parisons. The validity of the *Wechsler Intelligence Scale for Children* for Southern rural Negroes was questioned by Young and Bright (123). Their subjects were 81 Negro children in Georgia, 70 of whom attended three rural elementary schools, and constituted all children 10 to 13 years of age in Grades IV to VII of these schools. Sixty of the fathers of these children were tenant farmers or farm laborers, and 21 were employed as unskilled laborers. The full-scale IQ for the children was 67.7; the verbal IQ, 73.9; and the performance IQ, 67.1. Altho the full-scale IQ places this group of children in *Wechsler's* category of the feeble-minded, the authors maintained that in terms of realistic social norms this classification is incorrect and that the group was probably "typical" of the standards of the culture. Extensive changes in the test would be necessary in order to take account of the culture and environment of the Southern rural Negro.

The hypothesis that the inferior test performance of the Negro results from inability to handle culturally weighted test material and from lower socioeconomic status was investigated by McGurk (78). As subjects he used 213 pairs of white and Negro high-school seniors matched for age, school attendance, school curriculum, and score on 11 items from the Sims record card. On a test, unspecified, he found that the performance of the white sample was significantly higher on total score. This was also found to be true for two parts of the test when the items were separated into those most dependent and least dependent on culture. In a comparison of the groups of comparable socioeconomic level he found no evidence that, as the socioeconomic status of the Negro rises, the racial test-score differences decrease. This procedure appears to be a promising way to investigate ethnic differences; however, in future studies the results should be evaluated in terms of the test used.

In a continuation of his studies of the Ceylonese, Straus (109) compared the mental test performance of individuals from 16 subculture groups at the University of Ceylon. On the *California Test of Mental Maturity* all of the groups showed a tendency, as noted in previous studies, toward relatively high verbal performance and low nonverbal performance. Green (48) reported similar patterning of performance among the higher educational levels and attributed it to the cultural rewards attached to verbal and scholarly excellence. An alternative explanation might be that the admission procedures of the University result in a selection of students with relatively high verbal and low nonverbal performance. If Green's explanation is to be accepted, the question arises as to the ages at which the pattern arises since Straus found no evidence of it in third-grade children.

Bilingualism

The adverse influence of bilingualism on scores obtained on verbal tests of intelligence has become generally accepted; Darcy (30) noted

only two studies in which this was not found. However, the measurement of the extent of influence remains a research problem. Altus (2) used two groups of dull children, one bilingual and of Mexican descent and the other unilingual and not of Mexican descent. The groups were equated for age, sex, and performance IQ on the *Wechsler Intelligence Scale for Children*. (The author neglected to indicate the number of subjects in his samples.) IQ differences on the Verbal Scale of the *WISC* favored the unilingual group by an average of 17 points, a highly significant difference. A subtest patterning, quite different from that found for mental defectives, was present. The author suggested that this patterning might be of value both in the differential diagnosis of true and apparent cases of mental deficiency in this particular minority group and in determining the handicapping influences of bilingualism for this group. Jones (67), with a similar research design, found an 11-point difference favoring unilingual English children over bilingual Welsh children.

Anastasi and de Jesus (6) obtained measures of language development and *Goodenough Draw-a-Man* IQ's for 50 Puerto Rican five-year-olds (25 boys and 25 girls) attending day nurseries in New York City's Spanish Harlem. Comparisons were made with the performance of 50 white and 50 Negro subjects of the same age. The Puerto Rican children did not differ significantly from the white and Negro groups in IQ. Altho inferior to both whites and Negroes in educational and occupational level of parents, they excelled both groups in mean sentence length and maturity of sentence structure. The authors suggested that the greater amount of adult contact in the home environment is one of the factors which accounts for this latter difference. The research should be extended to provide objective measures of adult contact.

Cattell's *Culture-Free Test* was used by Anastasi and Cordova (5) in a study of 176 Puerto Rican children in Grades VI thru VIII of a parochial school in New York City. The median obtained standard score of —1.25 corresponds to an IQ of about 80. Low socioeconomic status, poor mastery of both English and Spanish, and poor motivation and interest were indicated as influencing these results. The authors suggested that the tendency for the girls to score higher when the instructions were in English may reflect differences in extent of acculturation.

Johnson (62) developed a reaction-time technic for assessing the strength of effects of bilingualism. This technic requires the subject to list as many different words as he can in one of the languages during a five-minute period and then as many as he can in the other language. The ratio of one to the other gives a measure of relative fluency in the languages. Using a sample of 30 bilingual boys of Spanish descent, he obtained a correlation of —.41 between performance on the *Otis* and the ratio of Spanish to English words; that is, the higher the proportion of English words, the higher the *Otis* score. Score on the *Goodenough Draw-a-Man* test was unrelated to the *Otis* score, but was positively related to the reaction-time ratio, with a correlation of .42.

Genetic Influences on Intelligence

The relatively high interest in genetic influences on intelligence has not been matched with a proportionately large amount of research. Studies in the area seem to be bottlenecked by the inadequate development of methodology. Scott (104) suggested that the next steps must be made in the laboratory, in which it is possible to study simple types of behavior which are little affected by training. According to him the task then becomes one of finding different types of environment favorable to the development of different combinations of characteristics. A different approach was suggested by Bayley's study (8) of the subjects of the Berkeley Growth Study. She found that the similarities of children to their parents tend to increase as they become more mature, both in mental and physical characteristics; that is, they become more like their parents as they approach the mature status at which the measurements were obtained on their parents. She noted that the contributions of various factors to complex mental and physical functions have a different weighting at different ages and that this may in part explain the low relationships found in the early years.

The interest in genetic influences on intelligence continues to be reflected in studies of differential fertility rates among the various intelligence levels. Duncan (37) reviewed several studies in this area and raised a number of methodological questions. Hutton (60) found that Winchester scholars of a generation ago showed less replacement in offspring than the general population; however, the 1921-1925 Winchester group showed a greater increase in family size than the general population, perhaps enough for replacement.

Nisbet (85), considering the small negative relationships consistently found between intelligence level and family size, hypothesized that limited contact between parent and child in large families tends to retard verbal development. This hypothesis was tested on two large groups, numbering over 2500 subjects each, by partial correlation and by correlation of family size and intelligence at different ages. While the findings were congruent with his hypothesis, they also appear to be congruent with the hypothesis that parents with higher abilities, especially in the verbal area, tend to have fewer children. Anastasi (4) discussed a number of methodological difficulties involved in genetic and environmental studies.

Mental, Physical, and Physiological Interrelationships

Few investigators have attempted to determine the long-term effects of prematurity on development. A recent study by Howard and Worrell (59) dealt with physical, intellectual, and personality characteristics of 22 subjects between the ages of 8 and 19. They found no relation between IQ and prematurity, but found unsatisfactory adjustment for about half of the cases and a relatively large proportion of cases with defective vision.

The relation of intellectual functioning to pathology was investigated by Manson (81). A total of 668 patients for whom intelligence test scores were available were grouped into nine disease categories. Significant differences between the groups suggested a relationship between intellectual level and a hierarchy of these disease classes. Using Wechsler's deterioration ratio as a model, Manson established a similar ratio for the *California Test of Mental Maturity*, the test most frequently used with these patients. This ratio of mean nonlanguage IQ to the mean language IQ indicated a deterioration of more than 10 percent in the arthritic, neurotic, and ulcer groups; however, on a subsample of the neurotic sample to which the *Wechsler-Bellevue* was given, a deterioration of only 3.3 percent was reported. The validation of these findings on another sample would be desirable as well as more evidence concerning the validity of these deterioration ratios within specified ability ranges.

Kaldegg (68) attempted to determine the relationship of migraine to intellectual level and to personality measures. No personality correlates of a consistent kind characterized the 20 clinic patients on whom he reported; however, they were significantly above the average in intellectual level as measured by the *Wechsler-Bellevue*. The generality of these findings is difficult to estimate in the absence of adequate statistics on the distribution of migraine in the normal population. In helping to build up norms in this area, subsequent reports might well contain more background information on the subjects as well as a description of the populace generally served by the institution in which the study is conducted.

In an exploratory study, Caldwell and Watson (19) investigated the effects of sex hormone administration on the mental functioning of 30 elderly women with a mean age of 75 years. Psychological tests were given before and after six months of hormone therapy in which half of the group received estrogen and progesterone while the other half received an oil placebo injection. No appreciable change was found on the *Wechsler-Bellevue*, but significant differences were noted on the *Wechsler Memory Scale*. Improvement was found in the experimental group in terms of ability to think and willingness to expend energy in intellectual activities. Improvement in memory was also found in respect to meaningful and logical material.

The development of tools for assessing the abilities of special groups or the modifying of instruments used on the normal populations for use with these groups is an ever pressing problem. Since the last review, special attention has been directed toward making the *Wechsler Intelligence Scale for Children* applicable to the blind and deaf. Scholl (103) suggested modifications necessary to make it applicable to the blind and partially sighted. Graham and Shapiro (46) suggested pantomime instructions to make the *WISC* applicable to the deaf child. The verbal element in the intelligence scores of deaf children was studied by Glowatsky (44).

From a factor analysis of data collected on patients with lesions of the frontal lobes, Halstead (52) derived four factors: abstraction, power, memory, and modality. The independence of these functions was supported by an analysis of data collected on additional patients. These results, when compared with those obtained by Lansdell (72) on rats, indicate that the applicability for other species of such findings on brain functions can only be determined by empirical studies. In his research Lansdell failed to find any evidence of deterioration in performance as a result of frontal-lobe lesions.

In a study of 58 patients with localized cerebral lesions, McFie and Piercy (77) found that impairment of retention and learning was related to the size of the lesion rather than to its location whereas impairment of such intellectual abilities as the verbal, numerical, and spatial factors depended on the locus of the lesion. Milner (83), reviewing the literature bearing on the intellectual changes resulting from temporal-lobe damage in both monkey and man, concluded that the main deficit is a visual one and that in man even a unilateral lesion can impair understanding of complex visual material. Reitan (93) compared the *Rorschach* performance of 18 aphasic brain-injured patients with matched nonaphasic brain-injured patients and matched controls. The brain-injured patients showed a significant loss in intellectual functions, but no difference was found between the aphasic and nonaphasic groups.

Institutionalized and Defective Children

The intellectual development of children separated from their parents has been a topic of special interest for the past few years. Lewis (74), in a compact and carefully written book, described the development of 50 English children, 63 percent of whom had been separated from their mothers sometime prior to their admission to the Mersham Reception Centre in Kent. The percent of low-ability children appeared no higher than would be expected in view of their socioeconomic background and the parents' high rate of mental defects and disorders. Similar conclusions were reached by Bodman (14) from a comparison of 51 institutionalized children with 52 children living at home and with 23 children living in foster homes.

Charles (23) reported a second follow-up study for a group of subjects, 42 years old on the average, who in childhood had been judged to be mentally deficient. The results indicate that these subjects fared better than early prognosis would lead one to expect. The data need to be analyzed with reference to possible effects of regression toward the mean. Results obtained by Clarke and Clarke (25) need to be evaluated in similar terms. The initial report by Satter and McGee (99) on 24 subjects indicates that it may be possible, by item analysis, to select items from the 1916 *Stanford-Binet* which will predict the subjects who will show gains and those who will not. Using two groups of high-grade mental de-

fectives matched for CA and *Stanford-Binet* IQ, Vanderhost, Sloan, and Bensberg (114) conducted a study of the comparability of measures obtained on the *Wechsler-Bellevue* and the *Wechsler Intelligence Scale for Children*. Comparable results were found on the performance scales, but significantly higher means were obtained on the verbal scale of the *WISC* than on the *W-B* verbal scale, with the correlation between the scores only .54. The authors suggested that these results might be explained in terms of the *W-B* verbal scale not having enough "bottom," and they suggested that the *WISC* is to be preferred for mental defectives in the 11-16 age range. For a comparable age range Sandercock and Butler (98) compared the scores obtained by 90 mentally defective subjects on Form M of the *Stanford-Binet* with their scores on the *WISC*. The investigators concluded that the tests were equally valid measures of intelligence for this age and ability group.

Mental Abilities in Psychiatric Groups

Rappaport (92) compared the performance of schizophrenics and of patients with organic involvement on a battery of tests designed to reflect most adequately the areas in which psychotic patients show "deficit." He concluded that tests of deterioration may reflect "behavioral inaccessibility" to a greater extent than organic involvement. Cohen (27), in an analysis of factor analytic results previously obtained from use of the *Wechsler-Bellevue* with neurotic, schizophrenic, and brain-damaged male veterans, raised the question as to whether the *W-B* subtests measure the same common factors, or the same combination of common factors, in different neuropsychiatric groups.

The differing significance of tests among normals and among psychiatric cases is emphasized in a study by Hanvik (53), who noted that the usual relation between *Goodenough* and *Wechsler* IQ's is altered among children under psychiatric treatment. In a group from 5 to 12 years of age, the rank order correlation between the IQ's obtained on the two tests was .18; the mean *WISC* IQ for the group was 107 while the mean *Goodenough* IQ was only 94. Woolf and Gerson (120) studied the relationship between intelligence as measured by the *Stanford-Binet* and estimates of intelligence from the *Mosaic Test*. While results were moderately positive on normal subjects, success was poor for those children exhibiting patterns of response said to be characteristic of the emotionally disturbed.

Marked differences in the results for different tests were found among clinical groups of older subjects. Roth and Hopkins (95) compared the abilities of 20 senile psychotics with those of a group of 46 patients with affective disorders. All were over age 60. The two groups were not significantly different on repeating digits and defining words, but the senile psychotics were far inferior on matrices and on a test of knowledge of public affairs.

In a study of a representative sample of the incoming prisoners to a penal institution, De Stephens (34) found them to be generally low-average in intellectual ability as contrasted with their quite normal ability in dealing with problems of a manual or manipulative nature. The 200 white subjects obtained a mean IQ of 94 on the *Wechsler-Bellevue* and a verbal IQ of 90.

Intelligence and Personal and Social Adjustment

Matarazzo and others (82) investigated the relationship between anxiety as measured by Taylor's *Manifest Anxiety Scale* and various criteria of intelligence. No relationship was found with grade-point average or with score on the *CVS* scale. A slight but statistically significant negative correlation was found with *ACE* score. This result may be explained in terms of the depressing effects of anxiety on performance or as due to association of low intelligence and poor adjustment. For 82 nonorganic psychiatric cases, Purcell, Drevdahl, and Purcell (91) derived an "altitude score" on the *Wechsler-Bellevue:* the difference between the full-scale score and a weighting of scores on the three subtests on which the subject achieved his highest level. These altitude scores, in essence a measure of scatter, were positively related to anxiety and to degree of maladjustment as measured by the *Minnesota Multiphasic Personality Inventory*. Monroe (84), using an analysis of variance technic, found that adjustment and intelligence seemed to interact in producing scatter, and he questioned whether its presence should be taken as an indicator of maladjustment. Mandler and Sarason (80) studied the effects of anxiety measured in terms of subjective report. In a comparison of "anxious" and "nonanxious" cases, the latter were found to respond more favorably in stress situations.

Williams' experiment in which a high degree of relationship was found between performance under stress and *Rorschach* measures of emotional and intellectual control was repeated by Carlson and Lazarus (20). Their results do not support Williams' earlier findings. Altus and Altus (3) found a curvilinear relationship between certain *Rorschach* variables and intelligence, and Lotsof (75) reported relationships between *Rorschach* variables and language measures which he interpreted as indicating a need for revision in scoring methods.

Other studies in the area include investigations of the relationship of intelligence to awareness of poverty (41), to performance on the *Rosenzweig Picture-Frustration Test* (69), to conservative-liberal attitudes (96), to effectiveness in group achievement (106), and to the reliability of adjustment measures of the *Minnesota Multiphasic Personality Inventory* (118).

Conclusion

It has not been possible to summarize here all of the significant papers and investigations related to mental development which were published in the last three years. In selecting reports covering the same topics as in former reviews (with an extension into the adult years) it has been necessary to omit reference to a number of side currents and to publications primarily theoretical in nature. These are represented, however, in various special reviews to which reference has been made.

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CHAPTER III

Learning

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THE research in learning during the past three years has been plentiful and broad in scope. Altho there is much overlapping between education and psychology, an attempt has been made here to select those studies which are of direct interest to education. Studies of primarily a psychological nature were reviewed by MacCorquodale (87), Tolman and Postman (126), and Underwood (127).

The acquisition of a universally accepted definition of learning by learning-research people would be of great assistance in clarifying a number of issues. The tremendous increase in number of publications, coupled with a greater number of consumers who are able to profit from the results of research, suggests the need for a working definition. The development and acquisition of a universally accepted definition of learning need not limit either the number or variety of studies or the differences in perceptual or theoretical framework of the investigators. An acceptance of such a definition, however, would not only provide a more effective opportunity to synthesize for the use of research but also enable the researcher to make contributions that are more in harmony with the total field than is probable at present. Altho the name that is used to identify a particular phenomenon is not of significance in itself, the assumptions upon which experimentation is based are highly significant. It is often easier to make an assumption from the name given than from the reality itself. The influence of such a universally accepted definition of learning is sorely missed, and its development is the most critical need of the immediate future. The first steps in such a development would be the acceptance of several well-formulated definitions or concepts which could then be related to each other.

The Scope of Learning Studies

A substitute for a definition of learning may be found by identifying limits. The concreteness and specificity of the variable, for example, can be seen as a continuum. At one extreme is found "The Effect of Long Intertrial Intervals on the Limit of Eyelid Conditioning" by Baron (11). At the other extreme, representing broadness and abstractness, are found such studies as "Some Relations Between Techniques of Feeding and Training During Infancy and Certain Behavior in Childhood" by Bernstein (15). Somewhere between the two is the relation of the development of the whole child to achievement, for example, Whaley's study (133).

The concrete and the specific are essential to understanding learning to the degree that they help to fill in gaps in knowledge or to verify theory. They can become minutiae when relevant to neither. The broad and abstract are necessary to the degree that they deal with the search for hypotheses or the pointing out of direction.

A second continuum illustrative of the scope of learning studies deals with the degree to which the experimental factor is related to the subject. Some studies (13, 70) employ experimental factors over which the subject has no control. Others, such as studies of the effects of noise (33) and of praise and reproof (80), employ experimental factors which the subject surely perceives but may choose to ignore. Still others, such as studies of the learning of moral standards (5) and the development of abstraction ability (119), are studies of characteristics that probably are developmental in nature and, therefore, influenced by a wide range of experimental factors, many of which are intimately related to the subject.

If the proportion of the total number of learning studies published during the past three years were considered the criterion of significance for a particular type of research, studies in which the experimental factor is closely related to the physiological processes of the subject would rate very high. Nolan (102) studied the effects of neonatal anoxia on the learning of rats. Russell (113) was concerned with the relationship between vitamin-mineral supplement and classroom learning. Thompson and Kenshalo (123) studied habit reversals as affected by thyroid hormone. Hunt, Jernberg, and Otis (69) measured the effect of carbon disulphide convulsions on a conditioned emotional response, and Evarts (48) attempted to establish the effects of the ablation of auditory cortex on auditory-visual association. The effect on learning of amino-acid deficiency was studied by Bevan and Freeman (16), and the effect of nicotine by Essenberg (45). McFie and Piercy (88) dealt with the effect of locality and size of cerebral lesions on learning. Not quite so closely related, but in the same general category, are the studies reported by Ferster (49).

A third continuum describing the scope of what is generally accepted as learning deals with what is done to the learner after learning has taken place. At one extreme, reinforcement is used in an attempt to make the learning more lasting. On the other hand, extinction is used in the attempt to eradicate its results. Diamond (38) investigated the effect of reinforcement on extinction. Transfer might be considered a mid-point on this scale if the study of transfer is interpreted as the attempt to discover whether or not learned behavior has been sufficiently generalized to be activated by a different but similar stimulus. Duncan (40), for example, found that transfer increased directly both with the degree of first-task learning and with intertask similarity. He attributed this to response generalization as well as to learning "how to learn." Hammer (60) also studied a type of transfer. Harcum (62) found no demonstrable difference in amount of effect between forward and backward association.

There may be some question as to whether incidental or latent learning should be placed on this continuum along with transfer. Incidental and latent learning might be considered byproducts or peripheral products, in that the learned behavior may merely have been broader in scope than was expected from the stimulus. Brown (22) investigated a number of factors and found only that more was learned in eight tests than in four. Bahrick (7) used high- and low-incentive groups to determine the effect of incentive on incidental learning. His study showed that high-incentive conditions produced higher results on one test and significantly lower results on another. Saltzman (114) concluded that the higher scores of the intentional learners in previous studies were due, at least in part, to the fact that subjects were *not* required to perform the orienting task. The significance of the influence of set would be a factor in the acceptance or rejection of such an interpretation. Bitterman and McConnel (18) in studying the role of set found that differences occurred in one task but not in another. Aborn (1) indicated that subjects were less likely to counteract inhibiting effects by rehearsal, overlearning, or increased motivation. Katz (72) suggested a re-examination of the principle that set and instruction to learn are universally more efficient in promoting learning than are lack of set and instruction. In this same framework, inhibition would fall nearer the extinction end of the scale.

Hall (59) and Hilgard and others (65) conducted studies in which meaningful learning was investigated. What, for educators, are the implications of the fact that so few studies in learning deal with the meaning of the material to the learner? Another group of studies which differ but are related includes those dealing with stimulus predifferentiation (10), stimulus generalization (20), the effects of nonreinforced trials (29), verbal conditioning (46), and irrelevant stimuli (61). Underwood (128) had published 12 of his studies of distributed practice by May 1954. These studies appear to assume that distribution of practice is a learning variable. Adams and Reynolds (4), however, concluded that distribution of practice is a performance rather than a learning variable.

The current literature on learning includes problems ranging from process to outcomes, from what is done to what is received, and from strengthening to obliteration. It also includes studies of the quality of the subjects, the complexity of the task, and the potency of the situation. The broadness of the scope of what is considered learning is testimony both to the dynamic nature of the study of learning and to the need for more effective integration and communication.

Learning Theory

The research in learning theory has been most productive. In the past there appears to have been a tendency to accept uncritically the proclamations of a few authorities. Recently there has been a fairly thoro examination of several theories. A critical examination of five such theories was

made by Estes and others (47). Other critiques were offered by Adams (2), English (43), Smedslund (120), and Werntz (132). Smedslund also discussed learning in relation to Piaget's theory of child development. Restle (108) derived three empirical laws from a two-choice discrimination theory similar to earlier theories of Estes, Bush, and Mosteller. English dealt directly with roots of learning theory. He discussed the influence of current practice and pointed out the atomistic philosophy underlying connectionism. He also proposed an alternate interpretation. Brown and others (23) discussed current theory and research in motivation.

Porter (105) tested two hypotheses stemming from Hull's reinforcement theory. Iwahara (70) in a study of learning as a function of food deprivation found results not consistent with Hull's theories. Nicholson (101) tested two theories by studying the influence of anxiety on learning. Kilpatrick (74) studied two processes in perceptive learning. Gibson and Gibson (54) found no evidence to *require* a theory that an accurate perception is one that is enriched by past experience.

In a study dealing with personality correlates of the galvanic skin response, Efron (42) interpreted the results as consistent with the drive-reduction-reinforcement theory of learning, and not consistent with the continuity notion of autonomic conditioning as suggested by Mowrer. Denny and Adelman (37) developed and are testing a new approach to the interpretation of learning which they term "elicitation theory." Elicitation emphasizes the importance of reward objects or goal objects in instrumental learning but not in terms of reward strengthening prior responses. The strengthening of a response comes with the consistent elicitation of a response. In other words there is no delay in reinforcement gradient. Reinforcement or strengthening occurs simultaneously with the eliciting of the response. All learning, according to this theory, is fundamentally classical conditioning.

Thorpe and Schmuller (124) included in their volume explanations of a number of theories of learning that have application to education. Each chapter dealing with a theory includes a statement of the theory, a review of the experimental verification, a critique, and a discussion of its significance for education. A chapter is also devoted to the pointing out of the similarities of the theories. The prime strength of presentday learning theory is that it continues to expand by taking an increased and more pertinent number of findings into consideration. Its major weakness is its lack of usefulness to the teacher in the classroom. There are several obvious explanations for this.

Methods of Teaching in Relation to Learning Outcomes

The teacher is—or should be—primarily concerned with the effects of his actions upon his pupils. As one might expect, a large number of investigations of this relationship have been carried out, both by educators and by psychologists.

During this period there were several studies comparing two or more teaching technics. Carlson (30) and Guetzkow, Kelly, and McKeachie (58) studied the lecture and discussion methods. Di Vesta (39) claimed a slight advantage for a discussion method over an instructor-centered method. Bond (19) found a statistically significant difference between the effects of positive and negative stimuli, whereas Kosofsky (77) found no difference between positive and negative guidance in another study. Greenberg (56) studied the learning of chronic schizophrenics in directed and undirected situations. McKeachie (89) found no significant difference between student- and instructor-centered methods. However, Keston (73) found a "with comment" method of teaching appreciation of serious classical music significantly better than a "without comment" method. McKeachie and Hiler (90) studied a problem-oriented approach to the teaching of psychology. Balcziak (9), Bebb (14), Flood (52), Gross (57), and Lucow (85) all studied the relative effectiveness of methods of teaching. In the aggregate, the results of many such studies are inconclusive and somewhat confusing. Ruja's conclusion (111) that much work in this area remains to be done if the most effective procedures in teaching are to be identified seems quite sound.

A number of studies of a more specific nature but related to teaching method and learning outcomes appeared. The following are representative of such studies. Chasin (31) designed a study to estimate the effect of punishment of wrong responses in a law-of-effect experiment. Hall (59) found a relationship between word frequency and recall. Mech and others (94) suggested the desirability of 100-percent verbal reinforcement in a massed fashion. Gagne (53) concluded that performance decrement as a result of massed or distributed practice is not a universal finding in the learning of motor skills. Adams (3) concluded that pacing is not an important learning variable. The amount and quality of memory change was manipulated by Postman (106) by familiarizing the subject with the stimulus and providing him with general rules for classifying and ordering the individual item.

Wallen (130) found that the use of commercially printed drawings when labeled by students produced gains in factual knowledge that equalled or surpassed those made by students who completed and labeled freehand drawings. Klare, Mabry, and Gustafson (76) found that stress or emphasis placed on printed words had little effect on either the speed at which the material was read or its acceptability. A number of studies of the relationship of rest to learning, such as those by Adams and Reynolds (4) and Rockway (109), were made; neither was applied directly to school situations. Hovland (68) concluded that the effectiveness of positive or negative instances required to communicate a concept depends upon the type of instance and the special conditions. Mech (93) found that the set of the learner may be influenced by a teacher who has a strong preference.

Measurement of Learning Outcomes

There are a number of studies that are subjective in nature with no apparent controls. A study by Leeds (82) is an example. The values of such studies lie in areas other than those of critical experimentation. Other studies propose hypotheses which are broader than present measurement technics are able to handle. An example is the one by Fischer (51). Such studies are not intended to produce measurable results. There are also, however, many studies in which conclusive findings are intended and assumed when they are not justified.

Hayes (63) contended that the conventional group learning curves fail to reveal the really critical information about the learning process since the basic information is contained in the individual curves. This contention is consistent with the belief that rate is a significant factor in measuring learning. Scott (116) in a study of beginning swimmers found no difference in the learning rates of two groups taught by different methods, but she did find considerable variation in individual learning rates. This study suggests that results of other investigators might have been different if rate had been considered. As reported by Horton (67), a simplified course of study was superior to a lengthened one in the basic training of slow-learning airmen. The fact that the results were more obvious in this study may well be due to the elimination of rate as a variable. Ammons, Ammons, and Morgan (6) and Roloff (110) reported studies in which rate was found to be significant. Bahrick, Noble, and Fitts (8) revealed that the assessment of extra performance provided a way of measuring a visual motor task not measured by scores on motor tests. Cohn (32) found that two methods of measuring verbal learning were not equivalent. Dawson (35) found a need for greater reliability in measuring autonomic processes. Miller and Philbrick (96) used an interactional telemeter to analyze aspects of classroom teaching.

An attempt was made by Lowenfeld (84) to lay a foundation for the evaluation of growth thru creative products. Heilman (64) showed that a concomitant of learning from workbooks is lessened creativity in young children's drawings. These studies suggest that the measurement of outcomes is a broader task than has heretofore been considered. Purdy and Kinney (107) demonstrated five steps in an effective learning experience and concluded that the ultimate test of effective teaching is the extent to which students learn to learn. A number of workers (26, 97, 122, 136) developed models for analyzing data.

The Role of the Learner

One of the encouraging trends in learning research is that directed toward giving increased attention to the role of the learner in the learning process. At one time the S-R bond was considered an ample description of learning, with most of the attention given to what the experimenter

did. For example, there are a number of studies, such as that by Daily (34), in which verbal conditioning was attempted without the awareness of the subject. However, other studies are beginning to appear in which more concern is given to the learner. Wallach and Averbach (129) in a statement which applies to learning as well as to memory, pointed out that the contents of memory are usually defined in terms of the external events to which they refer rather than to the psychological processes that occur when external events are perceived. Enrick (44) found that anxiety level did not affect learning tasks with tuberculosis patients. However, Montague (98) showed that anxious subjects performed less well on difficult tasks and showed greater improvement as lists became easier. Gloye (55) found that the values of the context in which material appeared affected learning and retention. Bijou (17) pointed out that a discouraged retarded child was stimulated when work was adjusted to his level of mental ability and previous achievement rather than to class standards. Mathers (92) generalized that the characteristics of anxiety-supported responses are related to the intensity of the primary drive and to the level of existing stimulation. Several factors were shown to be related to learning outcomes; among these are drive level (24); social structure of the classroom (27); vocational plans (118); emotional, educational, and personal history (131); and frame of reference (134). Klare, Mabry, and Gustafson (75) attempted to relate human interest of reading material to its comprehensibility and acceptability by using personal words and sentences. They found no difference in immediate retention, but subjects found human interest material easier and more pleasant to read. Russell (112) found a relationship between spelling ability and visual and auditory discrimination. The learning of discrimination was significantly affected by punishment and experience according to Calvin (28).

Hoppock and Cuony (66) related a procedure for pretesting equated groups on two occasions to make certain of the equivalence. Parducci (103) cited a number of learning variables involved in the judgment of a single stimulus. Tindall (125) suggested the need for a clear-cut measure that would predict the course of human adjustment in more than just a general way. A large number of characteristics which relate to the role of the learner were studied. McKnelly (91) studied anxiety. The overt errors reported by Morrow (99) and Scheible and Underwood (115) appear to be closely related to anxiety. The effect of words of sexual and non-sexual meaning was studied by Kott (79). DeLucia and Stagner (36) attempted to differentiate between social structure in the classroom and academic success, and Sheldon and Carrillo (117) studied the relationship of parents, home, and certain development characteristics to children's reading ability. Intelligence and reinforcement were related by Basesco (12). Wedemeyer (131) found that gifted nonachievers were those who had earlier experiences that were unfavorable.

Pascal and Swenson (104) found mentally ill patients less able to learn than normal persons unless they were highly motivated. Michael and

Maccoby (95) found that an increase in learning thru audience participation was due to practice effects rather than motivation.

Age or sex was considered a learning variable by Dusenberry (41), Fields (50), Kostick (78), and Stevenson (121). Other studies dealt with advance information by Leonard (83), and oral-aural differentiation by Bradford (21). Lysok (86) found that punishment had no significant effect on syllable recognition threshold, and Kanner (71) found that rewarded animals resisted interference.

One might wonder, when confronted with all the variables that have been found significant to the process of learning, whether the results from any study can be considered valid unless all the possible variables have been taken into consideration. Burton (25) attempted to take into consideration a variety of teaching principles based on what is known about the growth of the learner.

A number of studies based on the organismic point of view are beginning to appear. One of the significant features about these studies is that they focus less on what the experimenter does and more on what the organism is becoming. Examples are studies by Langford (81), Nally (100), Whaley (133), and Woronoff (135). Such studies are making significant contributions to our understanding of the learning process. Since they are somewhat new in the literature, it may be profitable to consider one. Nally described the preadolescent height cycle for each child, using the Courtis adaptation of the Gompertz curve, often termed the Law of Growth. He also described the first cycle of reading achievement by the same equation. He then solved the height equation to determine the percent of development in height at the time the child would be 1/10 of 1 percent developed in reading. His results indicated that there was a very significant relationship between growth in height and learning to read.

Conclusion

There are a number of trends in the literature on learning that give evidence that a new frame of reference is being accepted. There is a change from concern for facts to a concern for generalizations and laws. There is a change of focus from the experimenter to the learner, from emphasis on outcomes to emphasis on process, from judgment based on magnitude to that based on rate, from the cross-sectional to the longitudinal basis, from specifics to patterns or configurations, and from independent findings to findings related to each other. The study of learning appears to be shifting from one phase in its development to the next and is apparently getting ready for its adolescent spurt.

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CHAPTER IV

Personality Development in Infancy and the Preschool Years

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MODERN personality theories assign a leading role in personality formation to the events of the preschool years. Altho the need for knowledge and understanding of the important early processes has long been acutely experienced, the relative dearth of sound studies concerned with early personality development is ample testimony to a continuing unbridged chasm between theory and observation. The scarcity of relevant studies is doubtlessly a function of several variables. One of these most certainly is a lack of technical devices for assessment of the behavior of young children comparable to those currently utilized in studies of adults. Perhaps of equal or greater moment is the cultural lag which continues to render efforts in this area less prestigeful than work in the more adequately financed and currently fashionable fields. In view of these considerations, the investigators whose products are reviewed in this article are to be commended for their attempts to extend our empirical knowledge of this crucial period of life.

General Contributions

Carmichael's revision of *Manual of Child Psychology* (18) presented a review of research in which most of the 19 chapters contribute to the topic of "Growth, Development, and Learning." The book was ably reviewed by Barker (9). Specially related to personality development in infancy and the preschool years are chapters on "Methods of Child Psychology" by Anderson (8), "Emotional Development" by Jersild (43), "Research on Primitive Children" by Mead (67), and a new chapter on "Social Development" by Anderson and Anderson (7), an area of development not treated in the first edition. Anderson and Anderson reviewed research and advanced a comprehensive theory of social development based on a concept of growth. Personality growth, viewed as differentiation and integration, is the emergence of originals: creativity and the enhancement of energy. Less-than-optimum growth is the result of environmental domination, psychological *entropy;* that is, the degradation of energy. According to the well-accepted second law of thermodynamics, entropy is a lowering of the quality of energy; in mathematical statistics entropy is the logarithm of probability. Personality development, however, is creative experience, ***negative entropy***, the occurrence of the unpredictable and the improbable, the transformation of energy into behavior of higher

and higher quality. Social development, thus conceived, is not synonymous with socialization, a process which too commonly represents a degradation of originality and a stifling of creativity in the child.

"Socialization" is the title of a chapter by Child (21) in the *Handbook of Social Psychology* edited by Lindzey (58). *Socialization* is used by Child as a broad term for the whole process by which an individual, born with behavioral potentialities of enormously wide range, is led to develop actual behavior which is confined within a much narrower range—the range of what is customary and acceptable for him according to the standards of his group. Child analyzed the socialization variables in specific systems of behavior in such areas as oral, excretory, sexual, aggression, dependence, and achievement. He also discussed the general variables of age, consistency, technics used, and the status of the socializing agent. Child presented theory, research methods, and documentation with research findings.

Other general reviews of the literature appeared. The past three volumes of *Annual Review of Psychology* contained chapters on "Child Psychology" by Harris (34), Koch (50) and Radke-Yarrow and Yarrow (77). Heinicke and Whiting (35) prepared an extensive list of bibliographies on personality and social development of the child. The U. S. Children's Bureau (89, 90) continued its mimeographed reports on research in progress relating to children.

Child-Rearing Practices

A comprehensive analysis of child-rearing practices in 75 primitive societies was made by Whiting and Child (91). They selected five systems of behavior—oral, anal, sexual, dependence, and aggression—and categorized data from each culture according to initial indulgence, age of socialization, and severity of socialization. Their aim was to test certain hypotheses derived from Freudian psychoanalysis which they adapted to social learning theory. Many detailed findings were reported, some consistent, some inconsistent with the hypotheses. Negative fixation seemed most clearly demonstrated in the effects of anxiety developed during the period of socialization for each of the five systems of behavior. Positive fixations seemed related to later childhood and to anal and sexual satisfactions. The evidence for a lasting effect of child-training practices on personality was more striking and consistent for oral, dependence, and aggression behaviors. Whiting and others (92) prepared a field manual for the cross-cultural study of child rearing.

Wolfenstein (94) reported for the culture in the United States trends in handling the impulses of the child as manifested in thumb-sucking, reaction to weaning, masturbation, and reaction to bowel and bladder training. She analyzed the contents of seven of the nine editions of the U. S. Children's Bureau pamphlet, *Infant Care*. In the past 25 years there

has been a general decrease in severity of child training with the most consistent trends toward tolerance of the child's auto-erotic impulses in thumb-sucking, soiling, and wetting.

Demographic Differences

Hoeflin (39) studied child-care practices in a random sample of 100 rural families in one Ohio county. She found the sources of their information about child care to be relatives and friends, printed material, past experience, professional aid, and lay groups. She developed a child-rearing scale in eight areas: toileting, sleeping, eating, parent-child relations, emotional development, discipline, role of father, and thumb-sucking. Her findings were essentially negative; families with high child-rearing scores came from all socioeconomic levels and used all types of child-care resources. Neither age nor education of parent seemed to have much influence on child-rearing practices.

Klatskin (46) analyzed questionnaire data from a selected sample of parents representing a narrow socioeconomic range: upper-middle, lower-middle, and upper-lower levels. All had a homogeneous background of experience in a rooming-in project. No significant differences among social classes were found in feeding, strictness of regime, or father's role. The only statistically significant difference was in toilet training, begun after 12 months in the upper-middle class, and before 12 months in the two lower classes.

A follow-up study of 44 of an original group of 53 New Haven Negro infants was made by Knobloch and Pasamanick (49). Measures of developmental progress were correlated with various individual and environmental factors. Negro infants between 18 and 31 months were fully equal in behavioral development to average white infants. A definite acceleration in gross motor development in the group of Negro children was maintained, but no other characteristic either developmental or in the sphere of personality might be interpreted as "racial."

Another study of the relation of motor development of Negro infants to child-rearing practices was made by Williams and Scott (93). Subjects were 104 Negro babies, aged four to 18 months, about equally divided into two contrasting socioeconomic levels, high and low. Infants from the low socioeconomic group showed significantly higher gross motor acceleration. Significant differences in child-rearing practices were also found; specific practices as well as the over-all home atmosphere were more permissive and less exacting among families of the low socioeconomic group. The findings suggest that motor acceleration is not a "racial" characteristic.

Relation to Development

McCarthy (60) offered the hypothesis that differences in child-care practices with girls and boys may account in part for consistently reported

superiority of girls in all aspects of language development. McCarthy held that the girl infant identifies more readily with the mother, a hypothesis also advanced for the preschool years by Sears and others (80) and supported by sex differences in choice of doll-play agents, in rated tendency to emulate teacher, and in choice of dependency objects. It is well known that stuttering is more frequent in boys than in girls. Moncur (69) compared 42 male and six female stutterers, aged 62 to 98 months, with normals of approximately the same ages. Significant differences were found in overdomination by the mothers of stuttering children, as shown in items of disciplinary action, holding the child to excessively high standards, oversupervision, overprotection, and undue parental criticism.

Klatskin (45) administered Cattell's *Infant Intelligence Scale* to 316 infants in the Yale Rooming-in Project whose parents had been exposed to a philosophy of leniency in child care. In comparison with the Cattell norms, Klatskin found a significantly higher percent of success on most items at 12 months, with the constant exception of vocabulary. She interpreted the superior performance of her 12-month-old and 13-month-old infants in the light of changes in child-rearing practices and stressed the need for restandardizing the infant intelligence scales. The author also pointed out the desirability of having a control group in child-care practices, which was not possible in this study. Klatskin and Jackson (47, 48) published a detailed and comprehensive report of their research methodology for the study of parent-child relationships in a hospital setting.

Sears and 10 collaborators (80) reported an elaborately conceived program of research which they called a "pilot study." They investigated child-rearing antecedents of aggression and dependency in 40 preschool children. The hypotheses were based largely on learning theory. They reported that most of the antecedent-consequent relationships discovered were of relatively low statistical reliability, but were congruent with the theoretical formulation of the development of dependency and aggression. Severity of food scheduling, weaning, and toilet training appeared unrelated to any of the several forms of later preschool aggression.

Essentially negative findings were reported by Sewell (81) and by Sewell and Mussen (82) in a study of 162 five- and six-year-old rural children. Using results on the *California Test of Personality*, teachers' ratings, and intensive interviews with mothers, they found no support for psychoanalytic thinking which maintains that breast feeding, demand schedules, and gradual weaning promote better adjustment than bottle feeding, regular scheduling, or abrupt weaning. Bernstein (12) also worked on the problem of the relationship between infant experiences and behavior in later childhood. His subjects were 50 children between 47 and 68 months of age selected at random from files of a well-baby clinic. His findings support the hypothesis that reinforcement increases the strength of oral drive during infancy, but do not support the hypothesis that thumb-sucking is due to sucking deprivation during infancy. Other findings

concern toilet training, constipation, collecting, and personality traits. Yarrow (95) studied the relation between nursing in infancy and later thumb-sucking in 66 children. Length of time breast fed and age of weaning had no statistically significant relation to duration and severity of thumb-sucking. Shortest feeding time was associated with most severe and persistent thumb-sucking. Martin and Kubly (65), on the basis of a 50-percent return to a questionnaire, reported 74-percent relative success in treating enuresis by conditioned response method.

Family Relationships and Attitudes

One of the most striking developments in the last decade has been a widespread acceptance of the idea that the effect of a particular event on the personality of the infant and young child is dependent upon the quality of the relationship existing between mother and child. Along with this recognition of the importance of the matrix in which given events occur is a tendency to minimize the role of particular practices as determinants of personality characteristics. Thus Mead (68), in a discussion of the effects of mother-child separation, condemned exaggerated statements about the role of single procedures, such as breast feeding, in personality formation.

As one might expect, the mother-child unit was the subject of most of the studies of family relationships influencing personality. Two areas of concentration are apparent: (a) the quality of the maternal relationship and its effect upon the child's personality and adjustment, and (b) the effects of early separation of the child from his mother.

Mother-Child Relationships

Nowlis (72) discussed the background of an extensive series of studies in which a systematic attempt was made to apply concepts developed in stimulus-response learning theory. Among the variables investigated was the mother's behavior toward her children in infancy and early childhood. The reader will be interested in comparing this S-R orientation to that formulated earlier by Herbst (37) utilizing Lewinian concepts.

A number of studies employed the Fels *Parent Behavior Scales* developed earlier by Champney (19, 20). The Fels Research Institute and its longitudinal study of human development was described by Lasko (56), who reported briefly on differences between the behavior patterns of mothers toward their first- and second-born children. An expansion of this study by Lasko (55) indicated that mothers tended to be less warm and more restrictive toward first- as compared with second-born children, but were generally consistent in their methods of rearing these children. Temporal changes in maternal attitudes and related phenomena were considered. Highberger (38) correlated ratings of mothers on four of the Fels scales with the early adjustment of their children in nursery school. No significant relationships were found. Highberger suggested her hypotheses

may be incorrect but was inclined to attribute her negative results to the relatively homogeneous behavior of the mothers she studied.

A methodological investigation of the Fels scales was carried out by Lorr and Jenkins (59), who factored the intercorrelations between the seven common factors which Roff (78) discovered in these scales. Lorr and Jenkins isolated three orthogonal second-order factors and rotated these to oblique simple structure. The rotated factors were described as relating to the treatment of dependence in the home, the extent to which training methods were democratic or authoritarian, and the extent to which the home was orderly or unorganized.

A preliminary report of a non-normative investigation of various aspects of early personality development was given by Escalona and others (26). The variables under study included determinants of maternal attitude and organismic characteristics of the child as they affect maternal practices, the latter an area that Mead (68) suggested needs examination.

Poor school adjustment of blind children was attributed to maternal rejection in a study by Barry and Marshall (10). Caplan (17) discussed disturbances in the mother-child relationship following unsuccessful attempts at abortion.

Early Separation

The study of personality changes following separation of the infant or young child from his mother (and family) is of clear theoretical import and of the greatest practical concern in connection with the handling of institutionalized children. The investigations published agreed with earlier studies regarding the damaging effects of early separation. Roudinesco (79) described three stages in the reaction of the young child to separation from the mother: protest, despair, and finally, denial of relationships with adults, this latter stage resulting in a pseudo-recovery marked by greatly increased self-centeredness. Bowlby (15) reported case material indicating that separation before the age of four and one-half years generated acute stress which might lead to hostile behavior in later life. Fischer (28) examined "unattached" preschool candidates for adoption with the aim of determining the effect of length of institutionalization and frequency of placements on intelligence test results. It was found that intelligent behavior in this group was related to general adjustment, which in turn was involved with the degree of normalcy of the parent-child relationship.

While the studies of this problem were consistent in finding separation to be undesirable, some contained various defects in design or interpretation of results. The troubles of institutionalized children would seem to be sufficiently apparent to make desirable more rigorous and systematic studies of their problems. The difficulties arising in research in this area may lead to serious controversy regarding results. Thus Stone (86) in a critique of studies of infant isolation maintained that it is the task of the research worker to specify exactly what is meant by "adequate social

stimulation," and in what respects it is adequate. Pinneau (74) criticized in detail the evidence presented by Spitz regarding the relationship between anaclitic depression and maternal deprivation. In his reply, Spitz (84) conceded nothing to this criticism while Pinneau (75) in his reply reiterated his major points.

Father-Child Relationships

The father was not entirely neglected during the period covered by this review. Stolz and others (85) compared 19 father-separated families with 51 control families without father separation. The father-separation occurred during the first year of life of the first-born child and was due to service in World War II. Interviews with fathers and mothers, observation of their children in nursery school, kindergarten, and other situations, together with the employment of doll-play and projective technics with the children indicated interesting differences between the groups. The return of the war-separated father created a stress situation for both father and first-born, the father assuming the role of a relatively severe disciplinarian and the child becoming alienated from him. The war-separated fathers showed greater concern with child training; their children had more serious problems in connection with eating, elimination, sleeping, and were more likely to manifest strong fears than were the controls. War-separated children had more difficulty in social relationships with their peers and tended to be aggressed against rather than aggressive.

The personality characteristics of air force officers were related to their scores on a test of child-rearing attitudes in a study by Block (13). "Permissive" fathers were evaluated as self-reliant, ascendant, and functioning effectively. Tasch (88) queried 85 fathers as to their role in the family and presented data indicating that there was some correspondence between what fathers thought they should do and what they reported doing with their children. There was evidence of a trend toward a more equalitarian parent-child relationship, but the fathers were not giving up their role entirely.

Sibling Relationships

Aspects of the school behavior of 384 five- and six-year-old children from white, two-child families were correlated with ordinal position of subject, sex of sibling, sex of subject, and age difference of sibling in a study by Koch (51). Girls were found to be more affectionate, more obedient, and less resistant than boys, but interpretation of the effects of sibling categories was complicated by interactions among the independent variables.

The psychological problem of homozygous twinship and the special role of identification with the identical sibling was the subject of a book by Burlingham (16) based on detailed observations of the motives and conduct of three pairs of identical twins. Included were sleep and developmental charts.

Frustration and Aggression

Otis and McCandless (73) employed observers' ratings of the aggressive and submissive responses of nursery school children during the initial and final phases of a presumably mildly frustrating task in order to test hypotheses derived from the Yale frustration-aggression theories. They reported findings generally consistent with the theoretical formulations. They also found teachers' ratings of the children's dominance and affection needs significantly related in the predicted directions to aggressive and submissive reactions during the frustration task, altho ratings of *Children's Apperception Test* protocols proved too unreliable to have utility for these personality dimensions. From a detailed reconsideration of the classic Barker, Dembo, and Lewin study of frustration and regression, Child and Waterhouse (22, 23) convincingly argued for substitution of the concept "quality of performance" for "regression." They contended that the original data can readily be interpreted as supporting a general interference hypothesis; namely, that quality of performance is lowered to the extent that interfering response tendencies are present. They further argued that this new explanatory hypothesis yields more verified specific predictions about the behavior observed during the experiment than does the "regression" interpretation originally proposed over a decade ago. This interpretation is consistent with recent theories of psychological entropy, defined by Anderson and Anderson (7) as the degradation of energy or a reduction in quality of behavior resulting from environmental domination.

Operating within the conceptual framework of learning theory, Sears and his colleagues (80) reported a comprehensive pilot study of the child-rearing antecedents of dependent and aggressive behavior in preschool children. While few of their findings were clear-cut, three main conclusions were offered: (a) that the kind and amount of frustration experienced by the child are major determinants of the properties of both the dependency and aggressive drives, (b) that there are radical sex differences in the processes by which these drives are developed, and (c) that pervasive differences in the relationship of boys and girls with the mother are under way as early as the second year of life. Ammons and Ammons (6) reported the doll-play interview to be a satisfactory technic for the study of aggressive responses and offered developmental data regarding these responses in boys. Altho they noted a peak in the expression of direct aggression at three years, they apparently omitted testing the statistical significance of this difference. Employing an interesting experimental play situation, McKee and Leader (62) found that three- and four-year-olds low in social status displayed significantly more aggressive and competitive behavior than children of higher social class. Body (14) reported a study concerned with the effects of specific situational factors upon nursery school children that seemed rendered invalid by uncontrolled variables; for example, a majority (7 out of 10) of one of her

experimental groups came from fatherless homes while none of another group came from such homes.

Miscellaneous Studies

Our understanding of the child's view of the perplexing world about him promises to be significantly extended by studies of the kind described by Katcher and Levin (44), who investigated selections made by preschool children from an assortment of different-sized schematic body parts. They selected sizes which they associated with images of the self, of mother, father, and larger children of the opposite sex. Among other provocative findings they reported test-retest correlations concerning the body part sizes ranging from a surprisingly stable .84 value for the self-image to a moderately stable .41 for father and to a very unstable .19 for the more familiar mother. The further finding that girls gave smaller self and larger opposite-sex choices than boys supports the evidence found by Sears and others (80) suggesting that extensive social role learning occurs during the preschool years. On the basis of systematic observation, Ames (3) sketched a broad developmental picture of the evolution of the sense of self during years one to four.

From an investigation of the questions used a generation ago by Piaget and repeated by Lerner in studies of the development of moral concepts in childhood, MacRae (63) found three relatively independent clusters in questions previously assumed to represent a unitary personality attribute. He also reported evidence indicating that an important differentiation can be made between the influence of emotional and of cognitive factors on moral judgments. Smith (83), using a mother's fairly detailed diary for data concerning the early childhood health, intellectual, and social adjustment status of six children, drew an interesting but necessarily nondefinitive picture of strong consistencies obtaining between these early data and the personal attributes of the same persons as rated by a third party a half century later.

Adjustment

Macfarlane, Allen, and Honzik (61) notably extended the empirical information currently available concerning the problem behaviors of normal children. In a longitudinal study of a fairly representative high-middle socioeconomic-educational level sample, they relied upon mothers' responses to a simple, open-ended behavior inventory. Among other interesting findings, they reported many significant sex and sib-order (first and nonfirst born) differences during the preschool years; the systematic declination of most, but not all, problems with age; and the identification of some problems, such as irritability, overdependence, moodiness, and negativism, as having more behavioral correlates than others, such as restless sleep, nail-biting, and enunciation difficulty.

Intriguing findings concerning the appraisal of adjustment in childhood were described by Gruber (32) in a study that clearly merits replication. He applied the concept of "task orientation" (TO) to childhood activities and developed a set of TO indexes suitable for use in a doll-play situation. Gruber reported that the data from his TO measure were significantly related to teachers' ratings of the kindergarten adjustment of youngsters nine months later, as well as to many ratings of individual personality traits. Koshuck (52) surveyed the adjustment of an unselected group of two-year-olds to nursery school and reported that 20 percent had difficulties of longer than one week's duration in making a comfortable and happy transition to nursery school.

Behavior Disorders

Interest in studies of parental personality attributes as related to schizophrenic reactions in their children appears to be a waxing phase. Using a suitable type of objective attitude survey, Mark (64) found that mothers of male schizophrenics described themselves as following child-care practices that were more controlling, and as either being more emotionally detached or more fanatically devoted to their sons than did the mothers of nonschizophrenics. Substantially confirming this picture was the report of Frazee (29), who compared a group of mental hygiene clinic child clients who subsequently developed schizophrenic reactions with a control group of presumably schizophrenia-free children from the same clinic. The mothers of the schizophrenically inclined were described as more inconsistent, overprotective, and negligent, and as less warm than the other mothers. To complete this portrait of the pathological family, Frazee reported the schizophrenics' fathers as also more inconsistent, less warm, and more overtly cruel and rejecting toward their children.

Using an experimental doll-play task, Krall (53) found that a group of accident-repeating (AR) children of average intelligence ranging in age from five to eight years who had experienced three or more hospital recorded accidents (mainly from falls and lacerations not accountable to adult carelessness) during the preceding four years made significantly more verbal aggressive responses and expressed less anxiety about aggression than an accident-free (AF) control group. The AR children were also found to differ significantly from the AF group in terms of greater frequency of school shifts and broken homes. Langford and others (54) in a small-scale but intensive pilot study of factors related to childhood accidents reported no significant physical, neurological, or ophthalmological differences between groups of AR and AF children. They gained an impression, however, that the AR children were more overactive, impulsive, and disorganized under stress than the AF control group.

Ellingson (25) studied the reactions to physiologic stress of four groups of children: normal, behavior problem, those with one epileptic parent, and those with one schizophrenic parent. He viewed his findings as evidence of physiological predisposition to behavioral maladjustment.

Prematurity

Howard and Worrell (40) studied the intelligence and personality of 22 subjects 8 to 19 years of age who had been premature infants in a large metropolitan hospital. The investigators reported 11 to be hyperopic, seven to have IQ's of 90 or less, and 11 to have undesirable personality reactions. In addition, five of the six children with IQ's of 80 or less had experienced severe delivery complications.

Hospitalization

Fischer (27) interpreted the results of infant intelligence tests to support her contention that a definite hospitalization reaction occurred in a large proportion, 33 percent, of institutionalized infants. As manifested by a general disinterest in environmental objects and either marked passivity or hyperactivity, this condition was viewed by Fischer as the consequence of an unsatisfactory mother-child relationship. Prugh and others (76) compared the effects of an experimental hospital care program, which included such notable changes as psychological preparation for and support during potentially traumatic periods, more frequent parental visiting opportunities, and the like, with the effects of a more traditional hospital care program. They reported a significant lowering of emotional disturbances under the new method that was particularly marked for children less than six years old. Eckenhoff (24), from an investigation of the relationships between anesthetic agent and postoperative personality reactions of 612 children after otolaryngological procedures, found 17 percent to have reactions at least partially attributable to inadequate preanesthetic or anesthetic management. For example, bed-wetting was five times more frequent following the use of vinyl ether than after any other anesthetic agent.

Technical Contributions

One of the pressing needs in the study of early personality formation is the development and refinement of measuring instruments adequate for the testing of the numerous and provocative hypotheses the literature abundantly provides. The use of conventional psychometric devices has not proved fruitful. Interest has focused on projective and play technics.

The *Rorschach Test* has been a common projective device employed with young children. The studies in the period under review concentrated on the normative aspects of performance on this test. Hemmendinger (36) presented data illustrating developmental changes in *Rorschach* responses as a function of age, trends being apparent as early as the fourth year. Allen (1, 2) interpreted serial *Rorschachs* given at intervals to his young son and daughter. One approach to children's *Rorschachs* was described by Halpern (33) in a book dealing with 40 separate test records of children ranging in age from two and one-half to 10 years.

Ames and others (4) analyzed 650 separate *Rorschach* protocols for each six-month interval from two thru five years of age, and for each 12-month interval from six thru 10. The normative values of these records, however, is restricted because of the limited range of the children's socioeconomic status. A separate publication by these authors (5) dealt with purely developmental aspects in the records.

Friedman (30) used the *Rorschach* to demonstrate that the perceptual functioning of schizophrenics represents a partial regression from adult levels. Schizophrenic subjects gave responses in many respects similar to those of three- to five-year-old children and different from those of normal adults. For some reason, the same material, in a condensed but otherwise almost identical version, was presented in a later paper (31).

A new projective test using sketches of family scenes was described by Jackson (42). Martin (66) maintained that a revised form of the *Wolff Security Test* has questionable validity because scores obtained from its use bore little relationship to scores from three different measures of insecurity which had considerable agreement with each other. Beck (11) reported the use of the *House-Tree-Person Test* with several hundred five- and six-year-old normal children, and smaller samplings of organic and nonorganic retarded children. The omission of details in the drawing of a house must be interpreted with caution for children under six years.

Play Therapy

The process of play therapy is of great importance because of its special suitability for young children and its hypothesized relationship to personality variables. An elaborate system for the analysis of the interaction of the therapist and child in the play situation was presented by Moustakas and Schalock (71). Lebo (57) studied the relative value of various types of toys in stimulating expression in play therapy, and Isch (41) systematically investigated the formal and methodological aspects of a controlled play situation organized around mother-child interaction. Moustakas (70) found that successive emotional changes occurring in play therapy could be classified into six levels of normal emotional adjustment. Some interesting problems unique to the filming of children's behavior were described by Stone (87) with suggestions as to their solution.

Conclusion

While the studies reviewed in this section are admirable in the effort expended in improving their instruments, it is to be hoped that future research will show a parallel effort in exploring new devices suitable for the study of personality development in the young child. One of the greatest handicaps to such study is the serious lack of satisfactory measuring devices.

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CHAPTER V

Personality and Social Development During Childhood and Adolescence

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PERSONALITY and social development continued to receive considerable attention from psychologists, psychiatrists, sociologists, and anthropologists during the past three years. Altho the number of studies has not noticeably increased, there appears to be more diversity. This, as Milner (45) suggests, may call for a more comprehensive cross-discipline approach and is a challenge indeed for educational psychologists as they attempt to synthesize, interpret, and develop a functional personality theory for classroom teachers.

The title, "Personality and Social Development During Childhood and Adolescence," has not appeared in the REVIEW since Blair's chapter (7) in 1950. However, chapters by Blocksma (8), Foshay and Green (19), Stagner (57), and Trow (59) are closely related and include many excellent references. This chapter includes a sampling of similar materials, but, since it deals with children of school age, much of the material has been selected specifically for teachers interested in further study of personality and social development at that age level.

In general, the trend toward a phenomenological frame of reference seems to continue. The individual is being viewed more and more as a unique, unified, and whole personality who has the ability to act according to his own self-determination and not just in response to present and past occurrences. This places major emphasis on striving and goal-directed behavior. However, the trend is not pronounced. Allport (2) expressed the problem succinctly when he stated that people are busy leading their lives into the future whereas psychology, for the most part, is busy tracing them into the past. He emphasized the dynamics of futurity and the unique style of life of every individual. Of course, Adlerians have advocated continuously the socio-teleological approach which Dreikurs (15) described. Grey (25) and Rattner (50) made a strong case for the close relationship between individual psychology and democracy. Long (41) clarified many of these views by comparing Adler and Allport on certain topics of personality theory.

Further progress in our efforts to integrate personality theory will depend on our ability to come to some agreement on psychological causation. The statement that all behavior is caused is almost universally accepted. However, there is considerable difference between emphasizing the past and emphasizing the future. Allport (2) and Ansbacher (3) presented causality and its relationship to personality theory.

Before examining specific research in personality and social development, it may be helpful to cite a few general references, which have appeared in the last three years, representing different points of view. Kluckholm and Murray (37), Maslow (44), and Witkin, and others (68) published rather extensive volumes on personality, motivation, and perception. There were many textbooks in adolescent psychology and educational psychology published during this period, each with sections devoted to personality and social development. Coladarci (14) and Seidman (54) presented detailed analyses of these textbooks in their books of readings. Books by Ausubel (5) and Wattenberg (63) were two of the most comprehensive in the area of adolescent development. The National Society for the Study of Education (46, 47) published two yearbooks which included chapters related to adjustment. In the series, "What Research Says to the Teacher," Ojemann (49) and Trow (60) presented in a functional manner the implications of research for adjustment and for learning. A comprehensive pamphlet on the adolescent was prepared by the Children's Bureau (61). Several books were published which represented the newer trends in personality and social development and which presented implications for a classroom climate conducive to maximum adjustment. These included books by Hopkins (29), Hymes (30, 31), Jersild (34), Kelley and Rasey (35), Lane and Beauchamp (38), and Wiles (67).

Adolescence

A number of studies designed to improve understanding of the adolescent's personality and social development were published during this three-year period. Frank (21) summarized newer ideas concerning adolescents and individuality. On the basis of a questionnaire study of adolescent problems, Roof and Robertson (51) suggested implications for parents and classroom teachers. Loban (40) made a study of social sensitivity among adolescents and found significant differences between the groups in popularity and in certain attitudes. Stone and Landis (58) investigated the relationship between family authority patterns and the adjustment problems of teen-agers. This study indicates that teen-agers in democratic families have more harmonious parental relationships and fewer adjustment problems than those in authoritarian families.

Experiments using small-group discussion and group psychotherapy technics with adolescents were reported. Driver (16) described the use of small-group discussions in counseling adolescents; the results appeared favorable. Shulman (55) used group therapy technic with 19 troublesome adolescents. The experiment resulted in many significant changes in the behavior of the boys who attended regularly. With the shortage of trained personnel for individual therapy, further research with group therapy technics may prove to be very practical and efficient for the improvement of personality and social adjustment among adolescents.

Juvenile Delinquency

Juvenile delinquency certainly is one of our most pressing problems. It is an important problem for teachers to consider, since delinquency not only is closely related to personality and social development, but it also is correlated highly with maladjustment in school. The report of the 1954 National Conference on Juvenile Delinquency (62) indicates that research in this area should continue to increase in quality and quantity. Brickman (11) made an extensive review of studies of causes and treatment of juvenile delinquency. He emphasized the trend toward viewing delinquency in terms of multiple causation and therapeutics. Gough and Peterson (24) attempted to identify and measure the predispositional factors in crime and delinquency. An assessment device was constructed which was capable of differentiating significantly between delinquents and controls. Lorr and Jenkins (42) reported on patterns of maladjustment in children. Five factors—socialized delinquency, internal conflict, unsocialized aggressiveness, brain damage, and schizoid reaction—were found in parallel analyses of boys and girls.

Hinkelman (27) made a comparative investigation of differences in personality adjustment of delinquents and nondelinquents by comparing delinquents with three nondelinquent groups: one from the upper, one from the middle, and one from the lower socioeconomic classes. Results favored the upper- and lower-class groups more than the middle-class group. Glueck (23) reported a systematic study of 500 delinquents carefully matched with a nondelinquent group. He stated that family background and home climate of the delinquent group were inferior and that the two groups differed considerably in school adjustment and recreational activities. The results point to an organic, dynamic pattern of causation neither exclusively biologic nor sociocultural. Wattenberg in a 1955 article (64), Wattenberg and Faigenbaum (65), and Wattenberg and Quiroz (66) made several investigations of delinquent children. A study of 11-year-olds revealed that "repeating" was highly associated with poor school work, low intellectual ability, membership in unruly gangs, and a reputation for mischief. In a study of patterns of delinquency, they found evidence to support the view that delinquency is frequently the product of a generalized personality disorganization of some type.

Altho these studies and many other careful investigations report generalizations concerning delinquents, the experts still find it difficult to understand and predict the behavior of any one adolescent. It appears that some research workers have overlooked the cardinal principle of individual differences and the ability of an individual to determine, in part, his future destiny according to his unique life-style. Luchins (43), discussing the theories and problems of adolescence, criticized the overemphasis on attempts to derive generalizations and suggested that we concentrate more on the study of the adolescent as an individual. More

research in this direction may prove to be very valuable for a greater understanding not only of delinquents but also of all adolescents.

Sociometric Investigations

There continues to be a large number of sociometric studies attempting to assess personality and social adjustment in the classroom. Gronlund (26) attempted to determine the relationship between teachers' and pupils' preferences by sociometric tests. He found a general tendency for teachers to prefer those pupils who were highly chosen on the sociometric test. Bedoian (6) investigated social acceptability and social rejection of the underage, at-age, and overage pupils in the sixth grade. Underage pupils received significantly higher social acceptance scores than either at-age or overage pupils, and overage pupils received the lowest acceptance scores. Kinney (36) reported a study of peer group acceptability at the fifth-grade level in a public school. In three classes in which the class was divided into small flexible groups there was an increase in social acceptability. Spector (56) carried on a study in one class in an attempt to change social acceptability by means of certain group technics. The experiment consisted of 30 sessions over a five-month period with a class of 31 children. The study indicated that security and belongingness made for a climate that aided the growth and development of social acceptability.

Forlano (18) measured the quality of social acceptance in some ninth-grade core and noncore classes. The core groups showed a significant gain in acceptance scores while the noncore groups showed a decrease in social acceptance. Bonney and Powell (9) investigated differences in social behavior between sociometrically high and sociometrically low children. In five of the 25 behavior categories there was a significant difference between the two groups. Children in the high group were found to be more conforming, smiled more frequently, and showed more cooperative group participation. Scandrette (53) compared classroom choice status with scores on the *California Test of Personality* and found that the total personality test scores clearly differentiated the group of least frequently chosen from the group of most frequently chosen students. The most significant differences were found in the area of self-adjustment. A study of social skills and actions of socially accepted and unaccepted adolescents was reported by Bretsch (10), who attempted to show the relationships between acceptability scores derived from peer choices of the pupil and the pupil's self-ratings in social skills. Pupils with highest acceptability scores reported a significantly larger number of social activities.

The majority of these investigations indicated that technics of this type appear to be a means of increasing understanding in personality and social adjustment; however, a few studies were not too encouraging.

Ausubel (4) investigated the relationship between sociometric status and "sociempathy" and found that the objective sociometric status of the perceiver was not significantly related to the accuracy with which he was able to predict his own status and position in the group. Alexander and Alexander (1) made a study of personality and social status by administering the *Thematic Apperception Test* to 27 children in the fourth grade. The study provided evidence that children's choices may not be a criterion of value on which to base adjustmental goals. Fox and Segel (20) examined a number of typical sociometric studies in an attempt to determine the validity of the choice-of-friends method of measuring social adjustment. They concluded that there is no evidence of any relationship between these ratings and social adjustment of an intrinsic and psychological nature.

Relationship to Academic Success

Buswell (12) investigated the association between social relationships and academic success and concluded that in general those students who succeed in their schoolwork also succeed in their social relationships with their peers. Jackson (33) studied the effect of classroom organization and guidance practices on personality adjustment and academic growth of students. He found that the method of classroom organization, such as departmentalization, does not necessarily affect sociometric status or personality integration within a classroom.

Hinkelman (28) reported the relationship of certain personality variables to high-school achievement. The data indicated that, of the personality traits investigated, objectivity, composure, and self-mastery had the strongest relationship to achievement in selected subject fields. Gaier (22) investigated the relationship between selected personality variables and the thinking of students in discussion classes. He found that the degree of anxiety, rigidity, and negativism affects the nature of the individual's class participation.

Technics for Evaluation

There continued to be a variety of technics utilized in an attempt to improve the evaluation of personality and social development. Lecount (39) described an experiment with a high-school class in which a large number of technics were used to assess social problems and to gain further understanding of the social relations of adolescents. Rothney and Heimann (52) reviewed 94 references dealing with the development and applications of projective tests of personality. This review is a comprehensive treatment of the validity and reliability, norms, and applications of projective technics; it also discusses new projective instruments. Ellis (17) surveyed research on personality inventories published between January 1946 and December 1951.

Ives and others (32) presented an interesting study of "neurotic" *Rorschach* patterns found for "normal" adolescents. Rating of 11-year-olds was described by Cattell and Gruen (13), and Nichols (48) introduced a new personality test for young adolescents.

Conclusion

Research in certain areas of personality and social development and many isolated studies were omitted from this review. There appears to be an almost unlimited number of studies dealing with preschool children and college students, but certain areas of research disappear almost entirely when the review of research is limited to children of public-school age. Perhaps the trend in the direction of an individual approach will encourage more varied research for the childhood and adolescent periods.

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CHAPTER VI

Aging and Psychological Adjustment

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THE past three years have seen a considerable amount of study of the psychological adjustment of people as they grow older. But the concept of adjustment as applied to adults in a modern society is so complex that these studies have merely served to outline the problem and to suggest some useful approaches to it, leaving a thoro exploration of it to the future. An important characteristic of current research in gerontology is the amount of study being devoted to middle age rather than to old age. This signifies an interest in the process of aging and in getting knowledge which will provide a basis for a preventive mental hygiene that will help people to make a better adjustment in their later years.

The Meaning of Psychological Adjustment in the Later Years

Scientists study psychological adjustment for two general purposes. One is the purely scientific purpose of getting an accurate description of the behavior of people; the other purpose is to find out how to help people become happier, more successful in their pursuit of the goals of life, or better adjusted. Both purposes are illustrated in current research on adjustment in the later years. Watson (59), in a critical review of studies of the personality of the aged, urged more of the first type of research and gave examples of possible studies. Dennis (19) wrote a critical survey calling for more rigorous research on groups of people who differ widely in age or in social circumstances.

The second purpose of the study of psychological adjustment is illustrated by studies by Busse and his associates (14, 15). They studied the problem of recurrence of periods of depression in normal old people and came to the conclusion that the best defenses against such maladjustment are habits and activities developed much earlier in life. This interest in preventive mental hygiene is the basis for research on people in middle age.

In a Conference on Psychological Research on Aging (3), Havighurst, Henry, Kuhlen, Peck, and Weinberg presented papers dealing with personal and social adjustment in the later years. The writers all were concerned with the problem of "successful aging" tho none of them was prepared to make a flat statement of what successful aging is. These writers all urged the study of people in middle age so as to get accurate information on kinds of behavior which presumably are related to successful aging or good personal-social adjustment. They agreed that adjustment has two

aspects. There is an outer aspect which is evaluated by external observers in terms of a person's capacity to function appropriately and efficiently in his dealings with the outer world. There also is an inner aspect of adjustment defined as the degree to which a person achieves a relatively integrated satisfaction of his various psychological needs and experiences a pleasurable sense of well-being, contentment, and relative freedom from unpleasant tension and anxiety. These writers proposed that psychological research on adjustment should be concerned with the definition and measurement of change thru time of the following characteristics: flexibility, expansion of emotional and intellectual interests, tolerance of ambiguity, and affective complexity or variety of emotional reactions to various situations or stresses. They agreed that many situations in adult life involve stress for the individual and that it is the manner of adaptation to this stress which constitutes the variable of greatest importance in successful aging.

The Measurement of Psychological Adjustment in Later Maturity

Some progress has been made toward the measurement of psychological adjustment, but much remains to be done. Inventories of self-reports of various kinds have been used and their validity studied in a limited way. Havighurst (28) reported evidence concerning the validity of the *Chicago Attitude Inventory*. Mason (39) used this and several other self-report instruments to compare a group of institutionalized old people with an independent group of similar age and with a group of young adults. Brozek (10) made an item analysis of responses to the *Minnesota Multiphasic Personality Inventory* given by a group of business and professional men aged 45 to 55 and by a group of male college students aged 17 to 25. Another method of measuring adjustment is to use a rating procedure, with interviewers or others who have observed the subjects serving as raters. Mason (39) used this method, as did Havighurst and Albrecht (29). The latter produced a scale for rating performance of older people in the principal social roles which they may fill. A third possibility is to make ratings or judgments of adjustment based on the performance of people on projective tests. This method is being used tentatively by several people employing the *Thematic Apperception Test* and *Sentence Completion Test*. The most refined work has been done with the *Rorschach Test*. Caldwell (17) reviewed this work, concluding that interpretations of the *Rorschach* for older people may go astray if they are based on experience with younger persons only. In others words, there are changes in normal *Rorschach* responses with age, and the personality interpretation of the aged person's *Rorschach* should be made only on the basis of a validation of this test with other kinds of personality data on older persons. Ames and her co-workers (2) classified *Rorschach* protocols of people aged 70 to 100 as normal, presenile, or senile.

Adjustment and Social Relations

Recent studies of the effects of aging upon social relations have been confined mainly to the study of people over age 60. The majority of the studies deal with special groups such as people living in public institutions, private homes for the aged, and retirement communities. Far less attention has been given to studies of the general population or to comparisons between groups.

Donahue, Hunter, and Coons (23) reported a study of the comparison between an experimental group in a home for the aged, where an intensive activities program was introduced, and a control group. A sociometric technic was used to measure socialization and integration in the group structure. A comparison between pretests and post-tests indicated that the activities program increased the social interaction of the participants. Burgess (11), employing a sociometric test, differentiated five levels of social relations in a community for the aged: conscious isolates, unconscious isolates, intimates with one person, intimates with two or more persons, and leaders. In the same study, an analysis of recreational pursuits indicated the highest percent of participation in solitary pursuits, followed by group, spectator, and audience participation. Comparison of happiness scores on an attitude survey with the amount of recreational activity showed that the men with the highest happiness scores participated in nine times as much group recreational activity as those with the lowest happiness scores.

Tuckman and Lorge (56), in a study of how older people appraised various periods of the life span in terms of 21 aspects of adjustment, found that the later years are considered least favorable for all aspects of adjustment with the exception of authority, prestige, and interest in religion.

A study of retired persons' membership in organizations and attendance at secular meetings and religious services was conducted by Webber (60). He found that three-sevenths of the respondents belonged to no organizations and that there was no consistent relationship between age and number of memberships. Altho nonmarried members belonged to more organizations, married persons attended meetings to a greater extent. People with 9 to 12 years of education tended to have the highest affiliation rate. He also reported that religious services are attended more frequently than meetings of secular organizations and that church attendance declines as age increases.

In a study of religious activity and personal adjustment in old age, as measured by an attitude inventory, Moberg (42) reported that people who formerly had been active in the church tended to be better adjusted in old age than those who had not been active church members. This study was confined to people living in institutions for the aged.

The relationship between health and social participation of older people was studied by Havighurst and Albrecht (29), using as subjects 100

people, 65 years of age or older, living in a Midwestern community. They found that good health was not a guarantee of high activity, good adjustment, or absence of senile characteristics. However, a high health handicap score showed some relationship to low activity and low personal adjustment scores.

Living Conditions and Personal Adjustment

A number of recent studies were devoted to the effects of various kinds of living conditions upon the adjustment of older people and attitudes toward aging. A major consideration in living arrangements for older people is that of financial resources. Smith (49) found a positive correlation between size of income and definite plans for retirement, with people in the income bracket of $6000 or over being most likely to have made plans for retirement, including plans for their living arrangements. Attitudes toward public homes for the aged were generally unfavorable. Altho a majority felt that it is the responsibility of their families to care for older people, they also were in favor of government assistance with this problem. Suggestions as to what the government should do were far more prevalent than ideas about what individuals or families should do.

Taietz (52) found some evidence that homes for the aged which are composed of fairly homogeneous groups and which have an equalitarian social structure tend to facilitate better personal-social adjustment than other institutions.

Davidson and Kuglov (18) reported a study of personality characteristics of the aged based upon the analysis of *Rorschach* responses. They found evidence that institutional groups assume the personality characteristics of the aged—a decrease of emotional responsiveness, creativity, interests, drive, and productivity—earlier than do noninstitutional groups.

Studies of retirement communities, such as Hoyt's study (30) of retired persons living in a trailer park, indicate that a great number of older people feel that living in a community of age peers offers greater satisfaction than living in a heterogeneous community. Sociability seems to be the major value attached to living in this kind of community. The adaptation of a community to the presence of large numbers of older people was described by Harlan (27) in a report on St. Petersburg, Florida. This type of community develops services and opportunities which aid in the adjustment of older people.

Work Adjustment

Because of the basic importance of work in the psychological adjustment of men and many women, there have been a number of studies of the work experience and work potentialities of older people. These studies suggest that flexible employment practices be developed which contribute

to the successful adjustment of older people. Lehman's book (34) on age and achievement summarized his years of work on the ages at which people make their outstanding and creative achievements in various walks of life. Dennis and Girden (20) studied the scientific activities of psychologists in relation to their age, finding that the highest rate of publication comes in the 30's and the 40's. Turning from creative achievement to the productivity of the ordinary man in the ordinary job, Breckinridge (9) collected examples of the successful employment of older workers in various types of business and industry. Bowers (8), studying personnel records of workers, concluded that older workers compare favorably with younger ones. Smith (48) came to a similar conclusion from study of the personnel records of a particular manufacturing company. Kleemeier (32) reported an analysis of age changes in psychomotor capacity and productivity. Belbin (6), studying difficulties of older people in 32 English firms, found a tendency for older people to move away from operations requiring continuous bodily movement and activity, especially when the worker was paced by a machine or conveyor.

There have been a number of studies of the work actually performed by older people. Lehman (35) studied the age distributions of workers in various occupations from 1890 to 1950 and found that older workers are overrepresented in occupations that are on the wane, stationary, or increasing only very slowly, as well as in jobs with low pay. On the other hand, there have been studies of the experience of older workers in new, growing occupations which indicate that older men are becoming more numerous and more acceptable in these areas. A striking example is that of the airplane pilot. Spealman and Bruyere (50) reported that the number who hold Class I medical certificates (the highest standard and required only of airline captains) and who are over 50 years of age is increasing rapidly and will probably double between 1957 and 1962. Miles and Shriver (41) studied aging in Air Force pilots, and McFarland (36) analyzed the psychophysiological problems of air transport pilots. Both concluded that the increasing number of pilots between 40 and 50 years of age are able to perform as well as younger men. In a study of truck drivers, McFarland, Moseley, and Fisher (37) found that older drivers were less likely to have accidents than younger ones and that there are some physiological and psychological handicaps for older drivers which are partly compensated for by increased experience.

Retirement

The past three years have seen a great deal of research on retirement and its relations to adjustment. The most general finding is that retirement has a different significance for different people, depending on the psychological meanings their work has had for them. Friedmann and others (25) and Hall (26) reported that people for whom work has strong personal values adjust with difficulty to retirement whereas others for whom work

has no great psychological value adjust easily to retirement. With this general finding as background, it is possible to interpret the variable findings of studies of adjustment to retirement. Thus, Silverman (46) cited evidence in support of the view that prolonged inactivity following retirement and the absence of marked positive interest in later life are conducive to mental (and physical) ill health. From the Cornell study of the effects of retirement on health, Streib (51) reported tentatively that retirement has no ill effects on the health of most people tho it may affect some people adversely. Michelon (40) found that retired people had a relatively easy task of adjustment when they had a number of vital interests outside their work and when their work did not have strong positive meanings.

Opinion continues to be far from unanimous on the relative merits of compulsory retirement at a fixed age as against flexible retirement when the individual no longer works effectively or when he wishes to retire. Shanas and Havighurst (44) found that members of professions tend generally to avoid retirement if possible. Burns (12) presented the economic arguments against compulsory retirement as early as age 65. The majority of writers favored selective retirement, but others, such as Johnson (31), argued that a compulsory retirement age is less objectionable than the other available alternatives. Whatever may be the attitude toward compulsory retirement, there is unanimity on the desirability of preretirement preparation thru group meetings or thru individual counselling. This point of view is well presented in the reports of Ackerman and McKain (1), Breckinridge (9), and Tuckman and Lorge (56).

Public Attitudes about Aging

The adjustment of older people depends in considerable measure upon the attitudes of other people toward them. Simmons (47) described the participation of the aged in various societies and pointed out that older people participate more fully and with greater satisfaction in most simple societies than in the modern industrial society. Barron (5) compared old people to a disadvantaged minority group in America. Tuckman and Lorge (57) found in a number of studies on the subject, that opinions about old people are generally erroneous or unsubstantiated by research, and that old people themselves, as well as younger people, have these attitudes. Havighurst and Albrecht (29) investigated the attitudes of adults toward a variety of possible activities of older people. They found some age and sex differences in these attitudes, but found general agreement upon a pattern of slightly limited and "age-appropriate" activities. This pattern is definitely less active and ambitious than the usual pattern of activities of middle-aged people, but certainly is an active rather than a passive pattern. Other studies bear on the question of how older people evaluate their own age status. Tuckman and Lorge (54) confirmed earlier studies

which indicate that the majority of people prefer to speak of themselves as middle-aged up to 70. Only after that age do they describe themselves frequently as elderly or old.

Health and Adjustment

A close relation between physical health and psychological adjustment has been assumed and to some extent observed for a long time. Current research indicates that this is a reciprocal relation. Good adjustment contributes to good health, and good health contributes to good adjustment. Barnes, Busse, and Silverman (4) explored the importance of factors, other than the strictly organic, in producing mental illness in elderly people. Caldwell (16) and Watson (59) summarized studies of the effects of sex hormone replacement in aged women. Eighteen months after the commencement of hormone therapy with a group of women whose mean age was 75, they found a small general increase of intellectual functioning, which they believe is lost if therapy is stopped. Thus, it appears that the adjustment of older people may be affected by specific chemical therapy. On the other hand, research indicates that the decrease of sex hormone secretion associated with the menopause is not necessarily causative of maladjustment. The studies of Benedek (7) and of Lazarsfeld and Kadis (33) indicate that menopausal difficulties may be due to previous maladjustment, and that the menopause may well be regarded as a developmental rather than an involutional phase of life. Mack (38), studying old people who were chronically ill, found that these people were generally less happy than old people in normal health but that there was a relatively well-adjusted subgroup among them whom she called the "hopeful" type. Tuckman and others (58), using the *Cornell Medical Index* and a supplementary health questionnaire, found that the number of symptoms of ill health reported by men (but not by women) decreased from age 61 to 88. They interpreted this as due to acceptance of poor health by the older men as a natural event which was not worth complaining about. It is probable that psychological adjustment can be improved by rehabilitation methods for older people who are crippled or bedridden. As an example of the results of a program of rehabilitation, Dobrin (21) reported generally successful results with a group of men and women who were residents of an old people's home and who averaged 77 years in age. Older people in general need more hospital care than they get, according to a survey of hospital utilization and hospitalization insurance reported by Falk and Brewster (24). While people over age 65 receive longer periods of hospital care than people under age 65, admissions per 100 persons are lower for the aged population than for the general population. This fact they attribute to the decreased ability of older people to pay for hospital care or for hospitalization insurance.

An interesting special field of research on aging centers about the use of electroencephalography to study the central nervous system. Busse,

Barnes, and Silverman (13), Silverman, Busse, and Barnes (45), and Obrist (43) found that cortical activity in people over age 60 differs on the average from that in younger adults. People who continue to work after the usual retirement age have *EEG* records more like those of younger people. However, it has not been found that *EEG* abnormalities are always present in maladjusted or senile persons. They concluded that there is more to adequate functioning in the aged than normal cortical activity as reflected by the *EEG*.

Education for Aging

The question has been raised insistently in recent years whether adult education should not provide educational programs aimed at improving the adjustment of older people. In response to this question a special committee was set up by the Adult Education Association under the chairmanship of Donahue, who edited a book (22) describing and evaluating the present status of education for aging. It is estimated that the number of people over age 65 enrolled in public-school education programs is between 5 and 20 percent of the total enrolment. In addition to this, there is a growing amount of preretirement education conducted by business and industry for employees, and there is some indication that Agricultural Extension Services and various university adult education programs are increasing their services to older people.

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[1] Corrected to December 1, 1955. Report errors immediately to secretary-treasurer.

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Richey, Herman G.
Robinson, Helen M.
Schaerer, Robert W.
Schwertman, John B.

See, Harold W.
Shane, Harold G.
Shores, J. Harlan
Smith, B. Othanel
Stalnaker, John M.
Tyler, Louise L.
Weedon, Vivian
Wendt, Paul R.
West, Leonard J.
Witty, Paul A.
Woellner, Robert C.

Indiana

Amatora, Sister Mary, OSF
Barr, W. Monfort
Bateman, Richard M.
Bechdolt, Burley V.
Bentley, Ralph R.
Clark, Elmer J.
Cooper, Dan H.
Downie, Norville M.
Eaton, Merrill T.
Fattu, Nicholas A.
Fay, Leo C.
Fox, William H.
Horton, Roy E., Jr.
Jordan, Thomas E.
Koester, Alfred C.
McCann, Lloyd E.
Payne, Joseph C.
Phillips, Beeman N.
Remmers, H. H.
Ryden, Einar R.
Scarborough, Barron B.
Standlee, Lloyd S.
Walsh, J. Hartt
Watson, Jack M.
Wilson, Elizabeth K.
Wright, Wendell W.

Iowa

Blommers, Paul
Bryan, Ray
Chadderdon, Hester
Davies, John Leonard
Dreier, William H.
Ebel, Robert L.
Eller, William
Feldt, Leonard S.
Gibb, E. Glenadine
Hagman, Harlan Lawrence
Hieronymus, Albert N.
Horn, Ernest
Johnson, Hildegarde
Lamke, Tom Arthur
Lindquist, E. F.
Lyle, Mary S.
Maucker, J. William
Morgan, Barton
Nelson, M. J.
Ojemann, Ralph H.
Pattison, Mattie
Peterson, Elmer T.
Rhum, Gordon J.
Silvey, Herbert M.
Singleton, Carleton M.
Spitzer, Herbert F.
Stroud, J. B.

Kansas

Anderson, Kenneth E.
Baker, H. Leigh
Comstock, George Alison
Cottle, William C.
Donohue, Francis J.
Fritz, Ralph A.
Obrien, F. P.
Powell, Jackson O.
Reed, Homer B.
Rundquist, Richard M.
Smith, Henry P.
Smith, Herbert A.
Tasch, Mrs. Ruth J.
Turney, Austin H.
Wood, W. Clement

Kentucky

Adams, Harold P.
Meece, Leonard E.
Oppenheimer, J. J.
Parsons, R. B.

Louisiana

D'Amico, Louis A.
Foote, John M.
Gaier, Eugene L.
Hunter, Robert W.
Loflin, Z. L.
Robertson, M. S.
Walker, George H., Jr.

Maine

Allen, Margaret E.
Raymond, Dorothy

Maryland

Anderson, Vernon E.
Bayley, Nancy
Birren, James E.
Broening, Angela M.
Carl, Mary Kathryn
Chapman, Harold B.
Hovet, Kenneth O.
Kramer, Grace A.
Lurry, Lucile L.
Newell, Clarence A.
Stern, Bessie C.
Tatum, Beulah Benton
Wiggin, Gladys A.
Woollatt, Lorne Hedley

Massachusetts

Arbuckle, Dugald S.
Austin, Mary C.
Baker, James F.
Banning, Evelyn Irene
Benne, Kenneth D.
Biggy, M. Virginia
Billett, Roy O.
Brown, Douglass
Burch, Robert L.
Carroll, John B.
Cayne, Bernard S.
Chase, W. Linwood
Cogan, Morris L.
Cornell, Ethel L.
Cotter, Katharine C.
Crossley, B. Alice
Crowley, Harry L.
Davis, John B., Jr.
Dolansky, Mrs. Marie P.
Durrell, Donald D.
Eames, Thomas H.
Everett, J. Bernard
Gibson, R. Oliver
Gunn, Mary Agnella
Hayden, James R.
Herberg, Theodore
Jones, Vernon
Kugris, Violet
Kvaraceus, William C.
Lincoln, Edward A.
Meder, Elsa M.
Moriarty, Mary J.
Moulton, John K.
Moynihan, Rev. James F., SJ
Murphy, Helen A.
Pitkin, Fred E.
Read, John G.
Richter, Charles O.
Rulon, Phillip J.
Sargent, Cyril Garbutt
Savignano, Leonard J.
Schweiker, Robert F.
Stoke, Stuart M.
Thibadeau, Charles R.
Tiedeman, David V.
Walton, Arline J.
Weaver, J. Fred

Michigan

Anderson, Harold H.
Baker, Harry J.
Bergman, W. G.
Blocksma, Douglas D.
Carter, Thomas M.
Chase, Vernon E.
Courtis, Stuart A.
Dahnke, Harold L., Jr.
DeLong, Arthur R.
Dimond, Stanley E.

Dixon, W. Robert
Dressel, Paul L.
Elliott, Eugene B.
English, John Wesley
Fowler, William L.
Frederick, O. I.
Fricke, Benno G.
Furst, Edward J.
Gex, R. Stanley
Goldman, Morton
Govatos, Louis A.
Greene, Mrs. Katharine B.
Hamilton, Jean F.
Harris, Grace M.
Harrison, Harold J.
Herrick, Theral T.
Hopper, Robert L.
Hubbard, Robert E.
Jackson, Joseph
Johnson, Leighton H.
Junge, Charlotte W.
Kincaid, Gerald L.
Koch, Harlan C.
Kovnar, Murray R.
Krathwohl, David R.
Lankton, Robert S.
McClusky, Howard Y.
McDaid, Elmer W.
Mallinson, George Greisen
Mason, John M.
Matteson, Ross W.
Meier, Arnold R.
Miles, Vaden W.
Millard, Cecil V.
Nelson, Clarence H.
Nemzek, Claude L.
Noll, Victor H.
Olson, Willard C.
Pflieger, Elmer F.
Pirie, Duncan A. S.
Potter, Muriel C.
Rankin, Paul T.
Reitz, William
Rugen, Mabel E.
Sangren, Paul V.
Seay, Maurice F.
Smith, Donald E. P.
Trow, William Clark
Warrington, Willard G.
Williams, Wilbur Allen
Wingo, G. Max

Minnesota

Archer, Clifford P.
Arny, Mrs. Clara Brown
Birkmaier, Emma Marie
Birmingham, Sister Digna, OSB
Boardman, Charles W.
Boeck, Clarence H.
Bond, Guy L.
Bossing, Nelson L.
Brueckner, Leo J.
Clymer, Theodore W.
Cook, Walter W.
Corcoran, Mary
Curtin, James
Dugan, Willis E.
Eckert, Ruth E.
Ellis, Frederick E.
Ford, Roxana R.
Friswold, I. O.
Grim, Paul R.
Hoyt, Cyril J.
Johnson, Donovan A.
Johnson, Palmer O.
Kearney, Nolan C.
Keller, Robert J.
Mork, Gordon M. A.
Rose, Ella J.
Smith, Dora V.
Stecklein, John E.
Van Wagenen, M. J.
Wrenn, C. Gilbert

Mississippi

Mitchell, Guy C.
Morris, John B.
Owings, Ralph S.
Phay, John E.
Segner, Esther F.
Staiger, Ralph C.

Missouri

Anderhalter, Oliver F.
Byerly, Carl L.
Capps, A. G.
Carpenter, W. W.
Coleman, Gerald Max
Drake, Richard M.
Gilchrist, Robert S.
Gray, Robert T.
Hazlett, James A.
Holland, Clement
Kohn, Nathan, Jr.
LaBrant, Miss Lou
Melcher, George
Reals, Willis H.
Safier, Daniel E.
Schaefer, Robert Joseph
Shamberger, Marvin
Voges, Bernard H.
Watkins, Ralph K.

Nebraska

Hurst, Francis M.
Perry, Winona M.
Rasmussen, Elmer M.
Saylor, J. Galen
Searby, C. Robert
Weyer, Frank E.
Worcester, D. A.

Nevada

Bertrand, John R.

New Hampshire

Durost, Walter N.
Hart, Irene W.
Morrison, Mrs. Harriet Barthelmess

New Jersey

Atkins, William H.
Bigelow, Merrill A.
Bole, Robert D.
Bryan, J. Ned, Jr.
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Campbell, Donald W.
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Coffman, William E.
Cunliffe, Rex B.
Damrin, Dora E.
Dragositz, Anna
Dyer, Henry S.
Findley, Warren G.
Forrester, Gertrude
Freeman, Paul M.
Grossnickle, Foster E.
Herge, Henry C.
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Jacob, Walter
Johnson, A. Pemberton
Lannholm, Gerald V.
Little, Marion Lois
Melville, S. Donald
Mosier, Earl E.
Myers, Charles T.
Plumlee, Lynnette B.
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Skogsberg, Alfred H.
Sterner, William S.
Stewart, Mrs. Naomi
Turnbull, William W.
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New Mexico

Crawford, Bonner M.
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Russell, John Dale
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New York

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Capobianco, Rudolph J.
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Studebaker, J. W.
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Super, Donald E.
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Thompson, George G.
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Tinkelman, Sherman
Townsend, Agatha
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Triggs, Frances Oralind
Upshall, Charles C.
Urell, Catherine
Varty, Jonathan W.
Vaughn, Kenneth W.
Vosk, Marc
Walker, Helen M.
Walling, W. Donald
Wann, Kenneth D.
Washburne, Carleton W.
Washton, Nathan S.
Watson, Goodwin
Weinrich, Ernest F.
Wesman, Alexander G.
Wilson, Mrs. Phyllis C.
Winterble, Mrs. Margaret R. M.
Wood, Ben D.
Wood, Ernest R.
Wrightstone, J. Wayne
Young, William E.

North Carolina

Bixler, Harold H.
Bolmeier, E. C.
Brown, William H.
Cartwright, William H.
Easley, Howard
Ellis, G. Gordon
Finney, James C.
Gwynn, J. Minor
Hunt, Jacob T.
Jordan, Arthur M.
Nolstad, Arnold R.
Ryan, W. Carson
Stone, James E.
Taylor, Hazel E.
Thurstone, Thelma Gwinn
Winston, Ethna Beulah

North Dakota

Cushman, M. L.

Ohio

Adell, James C.
Anderson, Earl W.
Ashbaugh, E. J.
Auble, Donavon
Benz, Harry E.
Betts, Gilbert L.
Blanchard, B. Everard
Bollenbacher, Joan
Bonham, Samuel J., Jr.
Caskey, Helen Crossen
Collings, Miller R.
Conrad, M. J.
Dale, Edgar
Doherty, Victor W.
Ebeling, George William
Edmiston, Robert W.
Flesher, Marie A.
Flesher, William R.
Foshay, Arthur W.
Gee, John E.
Gesling, Martha M.
Good, Carter V.
Harry, David P., Jr.
Heck, Arch O.
Hemingway, William Chase
Hendrickson, Gordon
Herrick, John H.
Hill, George E.
Horrocks, John E.
Kinzer, John Ross
Klohr, Paul R.
Knower, Franklin H.
Lazar, Nathan
Lehman, Harvey C.
Lehman, Ruth T.
Leith, Harold Rank
Luther, Gertrude Hawkins
Lyman, Howard B.
McConagha, Glenn Lowery
McFall, Kenneth H.
McKelvey, Frederick H.
McKim, Margaret G.
Mathews, Chester O.
Morton, R. L.
Pelton, Warren J.
Pounds, Ralph L.
Powell, Marvin
Pressey, Sidney L.
Price, Robert Diddams
Shreve, John W.
Spayde, Paul E.
Toops, Herbert A.
Toumey, Sylvester L.
Whitehead, Willis A.
Whitesel, John A.
Wood, Ray G.

Oklahoma

Angelino, Henry
Cox, Leonard W.
George, N. L.
Holley, J. Andrew
Mech, Edmund V.
Miller, Lebern N.
Morris, John V. L.
Pate, Evelyn Rebecca
Pauly, Frank R.
Pugmire, D. Ross
Rinsland, Henry D.

Oregon

Albin, Floyd B.
Baron, Robert B. Denis
Bernard, Harold W.
Brody, David S.
Farley, H. Kent
Leavitt, Jerome E.
Rummel, J. Francis

Pennsylvania

Amberson, Jean D.
Betts, Emmett A.
Billig, Albert L.
Botel, Morton
Boyer, Philip A.
Brittell, Robert W.
Castetter, William B.
Cattell, Psyche
Cheyney, W. Walker
Cobb, William E.
Craig, Robert C.
Cunningham, John G.
Davison, Hugh M.
Desing, Minerva F.
Detchen, Lily
Fischer, Harvey J.
Flanagan, John C.
Ford, Fred C.
Glaser, Robert
Gordon, Hans C.
Grizzell, E. Duncan
Hatcher, Hazel M.
Heaton, Kenneth L.
Hill, Mrs. Margaret Keyser
Hunt, Lyman C., Jr.
Johnson, Marjorie Seddon
Jones, Arthur J.
Jones, Miss Dilys M.
Jones, Lloyd Meredith
Knoell, Dorothy M.
Laird, Mary Alice
Lindvall, C. Mauritz
McNerney, Chester T.
Maney, Ethel Swain
Manwiller, Charles E.
Masters, Harry V.
Morneweck, Carl D.
Myers, Garry C.
Novak, Benjamin J.
Preston, Ralph C.
Shaycoft, Marion F.
Smith, Linda C.
Sochor, E. Elona
Stevens, Glenn Z.
Tate, Merle W.
Thomas, Maurice J.
Trabue, M. R.
Yeager, William A.

Rhode Island

Boyer, E. Gil
Scott, Helen E.
Thorp, Mary T.

South Carolina

Capps, Mrs. Marian P.
Edwards, Newton

South Dakota

Headley, John W.
Tieszen, D. W.

Tennessee

Bragg, Emma W.
Broom, M. E.
Brown, Ilene
Capehart, Bertis E.
Coleman, William
Davis, Robert A.
Dunn, Lloyd M.
Harap, Henry
Johnston, Aaron Montgomery
Kent, Druzilla Crary
McClurkin, W. D.
Norris, Raymond C.

Redd, George N.
Waters, Eugene A.

Texas

Anderson, Gordon V.
Barnett, Albert
Bateman, Jessie W.
Bliesmer, Emery P.
Borg, Walter R.
Burton, Floyd H.
Codwell, John E.
Colvert, C. C.
Daniel, Artie A.
DeVault, M. Vere
Ewens, William P.
Freeland, Alma Moore
Fruchter, Benjamin
Hall, Roy Maxwell
Haskew, L. D.
Horn, Thomas D.
Jahnke, Henry A.
Judy, Chester Jack
Kress, Roy Alfred, Jr.
McCown, Roger N.
McFarland, John W.
McGuire, Carson
Manuel, Herschel T.
Martin, Miss Clyde I.
Martin, Edwin D.
Munch, Theodore William
Murphy, Harold D.
Otto, Henry J.
Pratt, Edward
Reid, Jackson B.
Schmid, John, Jr.
Sells, Saul B.
Shea, James T.
Singleton, Gordon G.
Stovall, Franklin L.
Strevell, Wallace H.
Travers, Robert M. W.
Umstattd, James G.
Votaw, D. F.

Utah

Arnesen, Arthur E.
Eastmond, Jefferson N.
Reid, Howard T.
Woodruff, Asahel D.

Virginia

Truitt, W. J. B.
Weaver, David O.
Weisiger, Louise P.
Woodard, Prince B.

Washington

Budd, William Claude
Corbally, John E.
Edwards, Allen L.
Fea, Henry Robert
Hayden, Alice H.
Horst, Paul
James, Clyde Evan
Jeffrey, Harold B.
Lee, J. Murray
Mack, Esther
Osburn, Worth J.
Strayer, George D., Jr.

West Virginia

Brown, Sara Ann
Fish, Lincoln Ted
Kozak, Andrew V.
Purdy, Ralph D.

Wisconsin

Arnold, Mrs. Gwen F.
Barr, Arvil S.
Bjoraker, Walter T.
Bond, Elden A.
Conley, William H.
Cumbee, Frances Z.
Dalrymple, Julia I.
Eichsteadt, Arden C.
Erickson, Harley E.
Estvan, Frank J.
Eye, Glen G.
Fowlkes, John Guy
Gregg, Russell T.
Harris, Chester William
Harris, Theodore L.
Herrick, Virgil E.
Hutchins, H. Clifton
Inabnit, Darrell J.
Jensen, Kai
Jenson, Theodore Joel
Juola, Arvo Evalth
Klausmeier, Herbert J.
Kreitlow, Burton W.
Lake, Ernest G.
Mouly, George Joseph
O'Brien, Cyril C.
Peterson, LeRoy
Potter, Mary A.
Rarick, G. Lawrence
Rothney, John W. M.
Schott, Andrew F.
Stanley, Julian C.
Stiles, Lindley J.
Theisen, W. W.
Torgerson, T. L.
Traeger, Carl
Treacy, John P.
Wolf, J. Grove

Wyoming

Reusser, Walter C.

Foreign

Australia

Connor, David Vincent
Schonell, Fred J.
Staines, Robert G.

Brazil

Lourenco-Filho, M. B.

Burma

Spaulding, Seth J.

Canada

Ayers, J. Douglas
Crook, Frances E.
Dunlop, George M.
Flower, George Edward
Shevenell, Rev.
Raymond H., OMI

Ethiopia

Kingston, Albert J., Jr.

France

Liu, Bangnee Alfred
Orata, Pedro T.

Hawaii

Law, Reuben D.

Japan

Troyer, Maurice E.

Pakistan

Hamid-ud-Din, Mohammed

Philippines

Isidro, Antonio

Puerto Rico

Roca, Pablo
Rodriguez-Bou, Ismael

Turkey

Bridges, Claude F.

LIST OF ASSOCIATE MEMBERS BY STATE

Arkansas

Cole, Glenn Albert

California

Jantzen, J. Marc
Pesin, Byron I.
St. Lawrence, Francis James
Wickens, Lewis A.

Delaware

Hurst, W. Joan McCain

District of Columbia

Cary, James L.
Walther, Herbert K.

Florida

Eves, Benjamin Miller
Frank, J. H.
Pratt, Olga L.

Illinois

Kraeft, Walter O.
Mackenzie, Donald M.
Paul, Marvin S.
Sense, Eleanora
Trump, J. Lloyd
Wallschlaeger, Theodore W.

Iowa

Hampton, Nellie D.

Massachusetts

Wilcox, Glenn W.
Young, Marjorie A. C.

Michigan

Stern, Celia M.

Mississippi

Thompson, Ruby Mae

Missouri

Hopmann, Robert
Praxedes, Sister M.
Wolbrecht, Walter F.

Montana

Langbell, D. P.

Nevada

Sligo, Joseph R.

New Hampshire

Gardner, Rev. Laurence R.
Petroski, Joseph J.

New Jersey

Cabot, Michael Lawrence
Kentopp, Henry E.
Robinson, Richard R.

New York

Cosman, Charles B.
Fifer, Gordon
Graham, Mattie
Hao, Peter T. Y.
Herrick, Marvin W.
Keller, William E.
Martin, John Henry
Moore, E. Carleton
Ritter, John M.

North Carolina

Pittman, Joseph Avery

Ohio

Peters, Herman J.
Scott, Mildred C.

Pennsylvania

Brown, Woodrow W.
Coleman, Mary E.
Delacato, Carl Henry
Eberhart, Guy F.
Swinehart, George B.
Waller, Raymond L.

South Carolina

McArthur, L. C., Jr.

Texas

Farmer, James F.
Moses, Peggy Lou
Myers, Cloice E.

Utah

Hardy, Howard R.

Virginia

Gibboney, Dorothy L.
Smith, Stanley Vernon

Foreign

Canada

Parker, Tom
Whelan, Mary

LIST OF STUDENT AFFILIATES BY STATE

Arizona

Allee, Margaret

California

Fierman, Morton C.

Illinois

Rohan, William

Indiana

Bern, Henry A.

Iowa

Cook, Desmond Lawrence

Massachusetts

Anderson, Anna Marie
Curran, Mary Elizabeth
Glenn, John
Sonnenschein, Mrs. Joan Lois Goodman

Michigan

Rusch, Reuben Robert

New Jersey

Holcombe, James T.
Matthews, Carl L.
Meltzer, Stephen J.
Shoemaker, Robert Preston, Jr.

New York

Barry, Ruth E.
Bloomfield, Jack
Crewson, Walter
de Jung, John E.
Grudel, Regina
Karpman, Fred
Lind, Martin W.
Logan, Abraham
McKibbin, Arthur Donald
McSheehy, Brendan
Mitchelson, Ramona R.
Orr, David B.
Roper, Kennard S., II
Rossey, Paul W.
Smith, Homer I.
Tannenbaum, Abraham
Tufel, Gilbert R.

Pennsylvania

Shaffer, John Paul

Wisconsin

Belleau, Wilfrid E.
Halverson, Lolas
Heding, Howard W.
Jones, Margaret L.
Lehmann, Irvin Jack

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